Advant® OCS
with Master software

Functional Units Part 1
Commond Properties

User’s Guide

3BSE 003 849R201

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Chapter 1 Introduction

1.1 General

The function library available in an ABB Advant Controller 400 Series installation includes an extensive range of different data base elements and PC elements. A required control function can be built up with the AMPL language (ABB Master Programming Language).

Functional units are available to supplement the library for more complex functions.
The functional unit is a “package” of different program functions (such as PC elements and data base elements).

Each functional unit has a specific communication module for connection to the Operator station (for control and supervision). The operators handling in the Operator Station has a function adapted dialog. Standardized display elements are used for visual indications.

The packaging simplifies documentation and implementation of, for example, functions with both control function and associated operators actions via display screen and keyboard. PC elements and functional units can be used freely together.

Applications include feedback control, sequence control and different motor/valve controls.

The functional units are constituted of pre-prepared parts. These consist of different control functions or interfaces to a user designed control function and different operators, alarm and event handling functions.

The descriptions of the functional units for process signal connections, AI, AO, DI, DO include a certain hardware function to give a complete picture of the function. All other functional units are completely implemented in software.

NOTE

General knowledge of the Advant Controller 410/450 and Advant Station 500 Series Operator Station systems is required to fully understand the contents of this manual.

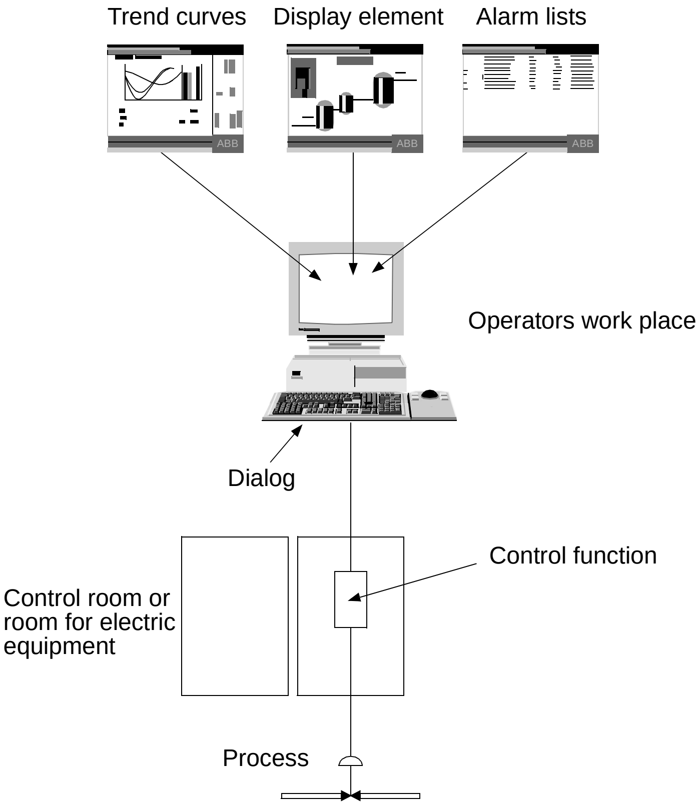


Figure 1-1. Software functions which can be included in a functional unit

1.2 Structure of the Manual

The manual, Functional Units, is for practical reasons divided into ten (10) physical parts. The contents of these parts are:

Part 1	Common Properties
Part 2	AI AO DI DO
Part 3	SEQ GROUP
Part 4	PIDCON RATIOSTN MANSTN
Part 5	GENCON GENBIN GENUSD
Part 6	MOTCON VALVECON
Part 7	PIDCONA
Part 8	DRICONS
Part 9	DRICONE
Part 10	MOTCONI

Functional Units Part 1 Common Properties, may be read first, in order to define the Functional Unit philosophy. This part also includes descriptions of common properties, valid for all Functional Units.

The rest do not have to be read in part number order. Each part stand by itself (together with part 1). A reader can start with Part 1 and then succeed with the part most urgent.

The contents of the different parts are:

Functional Units Part 1

- General descriptions of the functional units
- Descriptions of common system functions.

Functional Units Part 2

- AI (Analog Input). The functional unit AI (Analog Input) incorporates functions for:
  - Scanning of analog and pulse train inputs from the process
  - Filtering, linearization and scaling of such inputs
  - Storage of such inputs or internally calculated analog variables
  - Update blocking and input simulation
  - Limit checking
  - Operator station functions
  - Internal and external alarm detection and handling.
- AO (Analog Output). The functional unit AO (Analog Output) incorporates functions for:
  - Output signal storage and updating
  - Auto and manual modes of control
  - Limit checking prior to storage
  - Scaling and output of an analog control signal to the process
  - Operator station functions.
- DI (Digital Input). The functional unit DI (Digital Input) incorporates functions for:
  - Scanning of digital process inputs.
  - Filtering and inversion of such inputs.
  - Storage of input data
  - Update blocking and input simulation
  - Operator station functions.

- DO (Digital Output). The functional unit DO (Digital Output) incorporates functions for:
  - Output signal storage and updating
  - Auto and Manual modes of control
  - Inversion of stored data prior to output
  - Output of a digital control signal to the process
  - Operator station functions.

Functional Units Part 3

- SEQ (Sequence).
  - SEQ (Sequence) is a software package - a functional unit - designed for universal use in sequence applications.
- GROUP (Group).
  - GROUP (Group) is used for group-start and group-stop of motors, valves and other binary objects coordinated as a group in the process. These objects are normally controlled by MOTCON or VALVECON with which GROUP is compatible.

Functional Units Part 4

- PIDCON
  - PIDCON has been developed for control functions in different processes. It is therefore called a process controller.
- RATIOSTN
  - RATIOSTN is mainly intended for ratio control. This ratio control is performed in cooperation with a process controller PIDCON or PIDCONA.
- MANSTN
  - MANSTN is intended for control of unregulated objects.

Functional Units Part 5

- GENCON
  - GENCON (GENeral object CONtroller) is a general tool which enables the user to create desired control functions. This Functional Unit include a User Defined PC Program.
- GENBIN
  - GENBIN (GENeral object BINary controller) is a general tool which enables the user to create desired control functions. This Functional Unit include a User Defined PC Program.
- GENUSD
  - GENUSD (GENeral object USer Defined controller) is a general tool which enables the user to create desired control functions. This Functional Unit include a User Defined PC Program.

Functional Units Part 6

- MOTCON
  - MOTCON is a functional unit designed for the control of motors in different processes.
- VALVECON
  - VALVECON is a functional unit designed for the control of 2-position valves in different processes.

Functional Units Part 7

- PIDCONA
  - PIDCONA is a complete PID control function with auto tuning and adaptive control, including functions for operator interface and event handling.

Functional Units Part 8

- DRICONS
  - DRICONS is a complete function to integrate standard Drives based on Standard Application Program including functions for operator interface and event handling.

Functional Units Part 9

- DRICONE
  - DRICONE is a complete function to integrate engineered Drives based on System Application Program including functions for operator interface and event handling.

Functional Units Part 10

- MOTCONI
  - MOTCONI is a complete function to integrate INSUM standard motor controllers via LONWORKS Network, including operator interface and event handling.

1.3 Purpose of the Manual

The purpose of this manual is to give the Advant Controller 400 Series implemented information about the powerful library of predefined function units “packages”, in order to provide all the information needed for the use of the different functional units.

Functional Units Part 1, contains the following information:

- General descriptions of the functional units
- Descriptions of common system functions.

The other six parts include:

- Detailed descriptions of the design and function of the different functional units
- Examples of applications.

1.4 Other documentation

In addition to the unified documentation for the functional units offered by these series of Function Units Parts (part 1-10), there are other manuals which document individual types of program functions within a functional unit. There is, for example, a reference manual, *PC Elements Advant Controller 400 Series Reference Manual*, which embraces all of the PC elements included in the controller. The PC elements contained in any particular functional unit are also included in this. A corresponding manual is available for data base elements, *Data Base Elements Advant Controller 400 Series Reference Manual*. Both are valuable aids for practical use in the day-to-day design work, when knowledge of the function is available. Information in this manual is based on the following documents:

- *PC Elements Advant Controller 400 Series Reference Manual*
- *Data Base Elements Advant Controller 400 Series Reference Manual*
- *AdvaCommand Basic Functions User's Guide*
- *AdvaCommand User Interface Reference Manual.*

Chapter 2 Different Functional Units

2.1 Design Principles

In addition to the principles of the design of the different functional units, this section presents examples of the relations between the units.

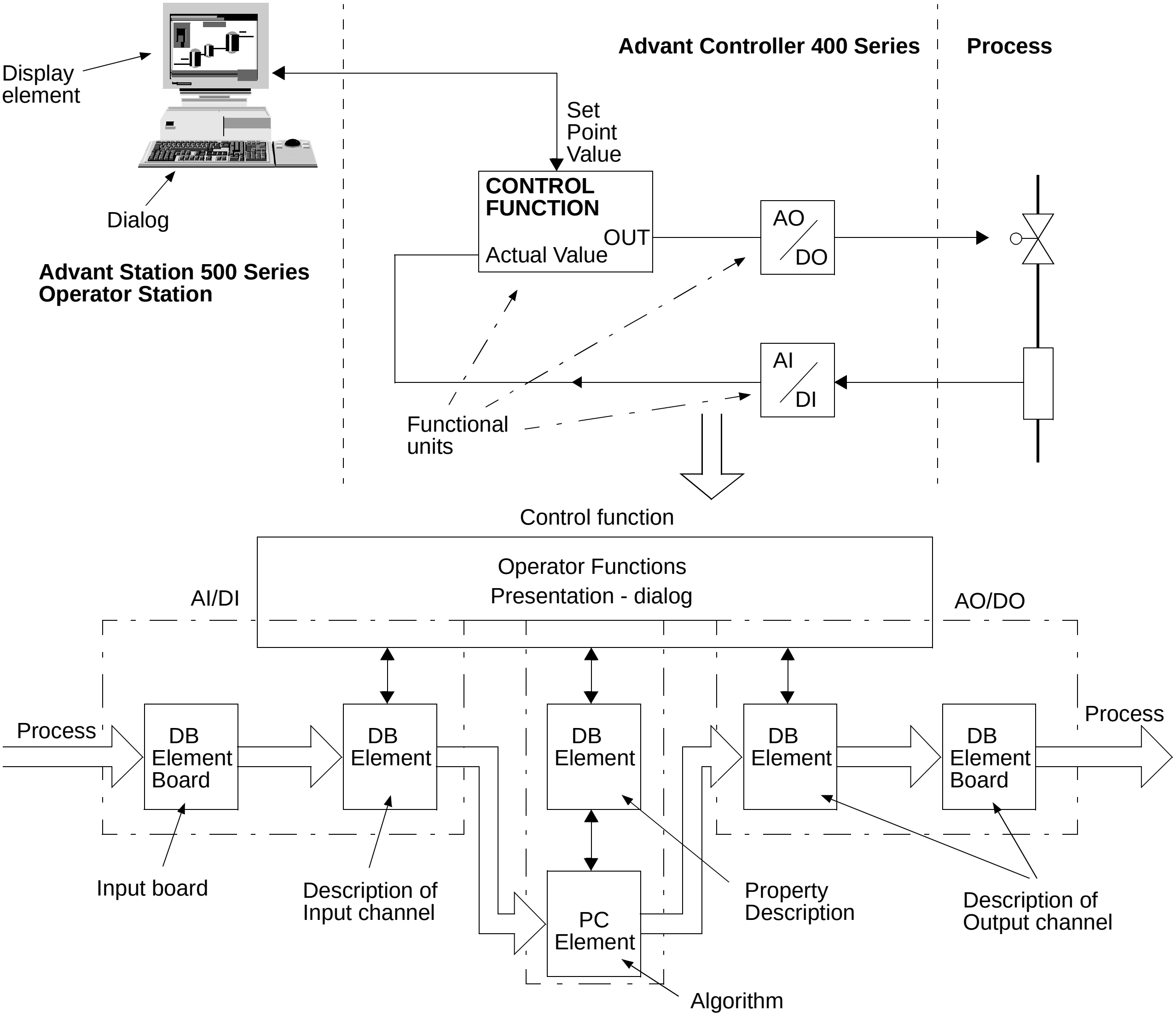


Figure 2-1. General application

Figure 2-1 gives a general picture of common applications of three functional units.
The application can be a control function or a motor or valve control function for which several functional units are used in combination.

The functional units are also used individually. Examples of this can be a measuring circuit with alarm activation and display screen presentation or a simple command function from operator to process.

The functional units can be freely combined with other PC elements.

The functional units can be divided into three groups on the basis of their construction and the extent to which the PC function is developed. The most important differences between the groups are that they offer different degrees of flexibility.

The PC functions of the three groups are as follows:

Group 1	No PC function
Group 2	PC function not determined
Group 3	PC function determined.

Other characteristics of the three groups and a definition of the functional units included in each group are described in the following sections.

2.1.1 Group 1 (no PC function)

The group embraces functional units in which the function is completely defined in data base elements. The units have fixed Advant Station 500 Series Operator Station functions.

Input and output units (software part for I/O) are included in the group.

The structure is shown in Figure 2-2. Each physical board got one DB element "BOARD", with board and common channel information for the specific board. The channel specific function is configured in the DB elements "CHANNEL", one for each channel. This type of functional unit do not contain any PC function.

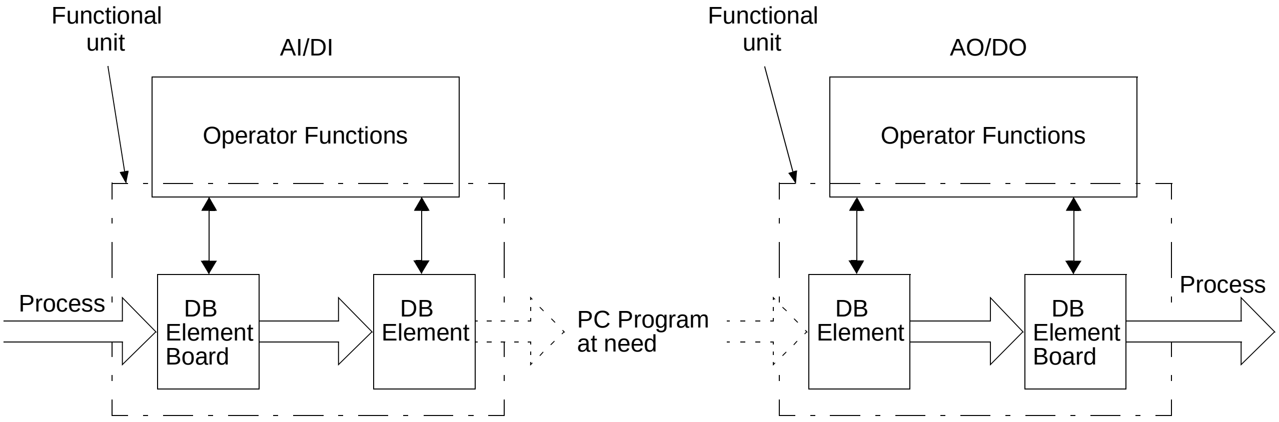


Figure 2-2. Functional units Group 1

The following functional units (with variants) belong in Group 1:

AI	Analog input
DI	Digital input
AO	Analog output
DO	Digital output.

2.1.2 Group 2 (PC function not determined)

The group consists of functional units with a user defined PC Program as well as PC Elements. The PC function is supplemented here by the user to obtain an application - adapted function. The units contain Advant Station 500 Series Operator Station functions which permit a certain application-adaption.

The structure is shown in Figure 2-3. The data base element is used mainly to configure Advant Station 500 Series Operator Station functions for functional units.

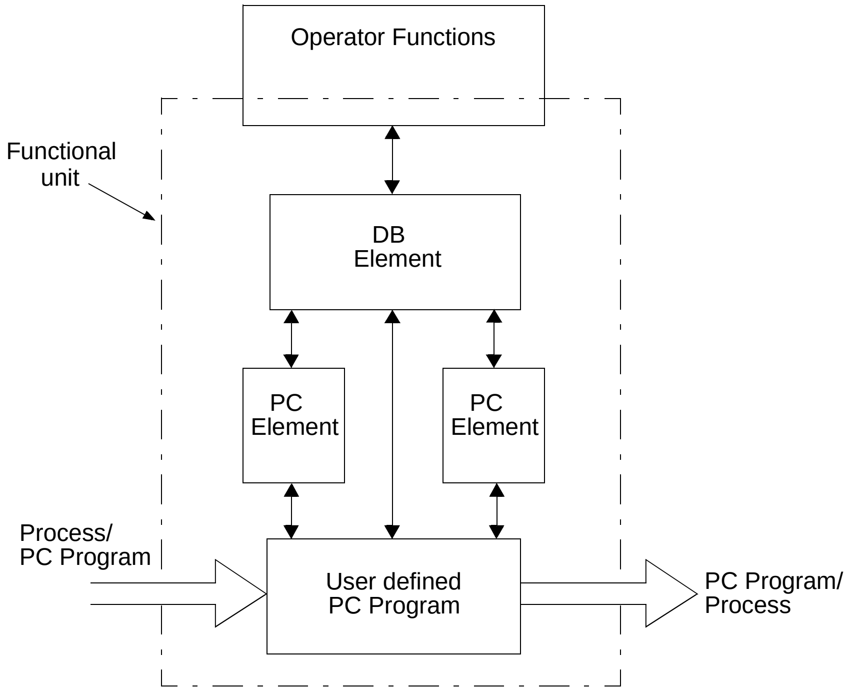


Figure 2-3. Functional units Group 2

The PC elements included in Group 2 functional units constitute an interface for signal exchange between the user-defined PC program and the operators function.

The following functional units belong to Group 2:

GENBIN	User-defined two-position control such as motor or valve control.
GENUSD	User-defined functional units.
GENCON	User-defined regulator
SEQ	Sequence. (The design of SEQ departs somewhat from Figure 2-3. This is indicated by the function descriptions of the different units.)
GROUP	Group start of motors and valves.

2.1.3 Group 3 (PC function determined)

The group consists of functional units with fixed PC and Advant Station 500 Series Operator Station functions. The structure is shown in Figure 2-4.

Characteristic of these units are that they have a well-reasoned control philosophy for a tested function, which makes them easy to implement.

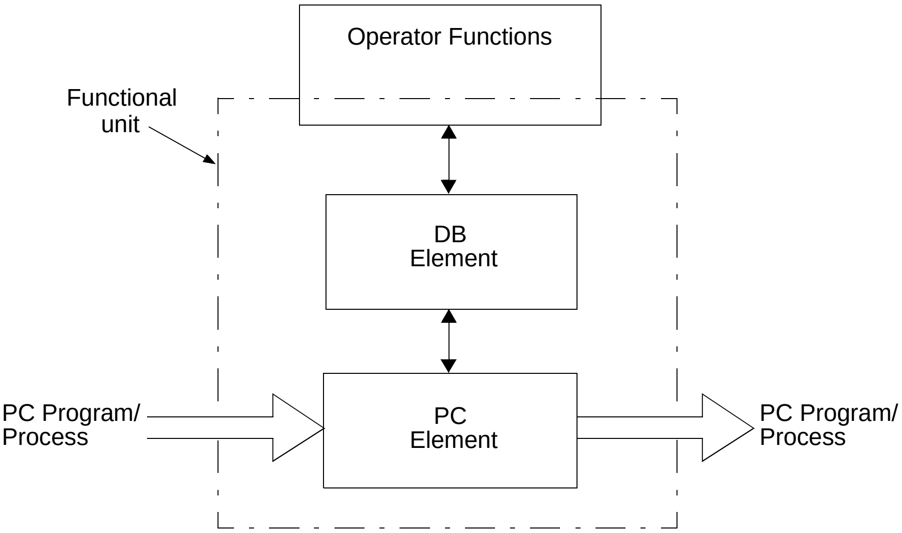


Figure 2-4. Functional units Group 3

The data base element is used mainly to configure Advant Station 500 Series Operator Station functions. In addition, the data base element serves as an interface for signal exchange between PC program/process function and operators function.

The functional unit contains a PC element. The PC element defines the control or feedback control function.

The adaptation to the application is performed through selection of parameters, both function and size parameters.

The following functional units belong in Group 3.

DRICONE	Engineered Drive Control
DRICONS	Standard Drive Control
PIDCONA	Process controller with auto tuning and adaptive control
PIDCON	Process controller
RATIOSTN	Ratio station
MANSTN	Manual station
MOTCON	Motor control
MOTCONI	Motor control
VALVECON	Valve control.

2.2 Application Example

A straight forward control loop is implemented with the functional units analog input AI, controller PIDCONA (or PIDCON) and analog output AO. The application principle is illustrated in Figure 2-5.

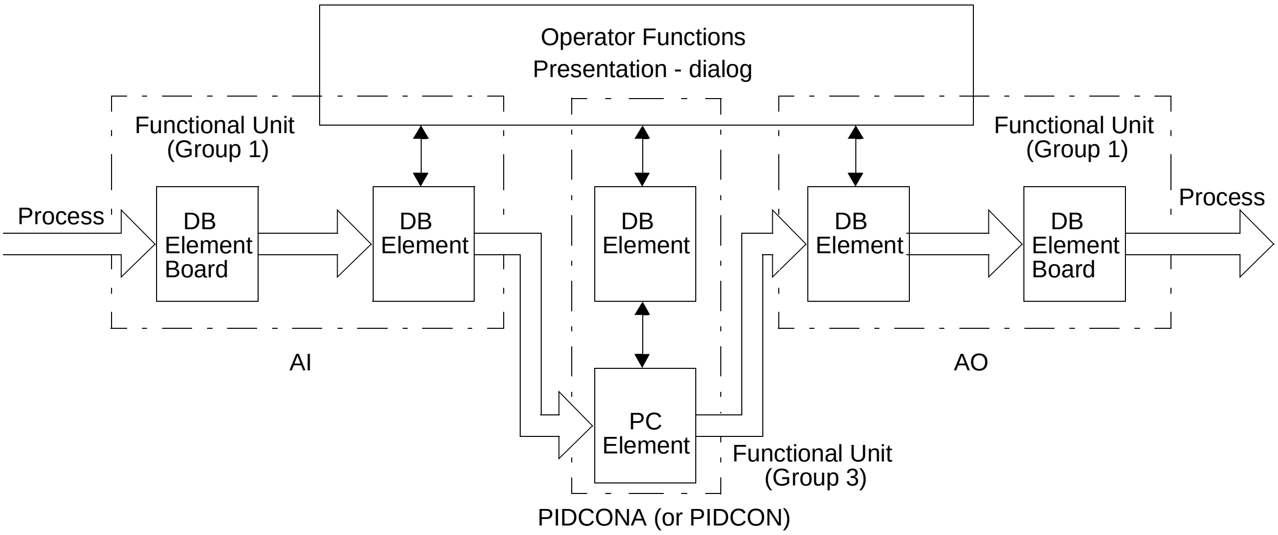


Figure 2-5. Application principle

Filtering, conversion and scaling of measured values to process-related units from the electrical signal type used are performed in AI unit.

The PC function in PIDCONA (or PIDCON) performs the control function itself. Depending on the control mode selected, the output signal to the control circuit control device such as a valve, is determined by the control algorithm or manually by the operator. (The control modes are presented in Section 3.10, Control Mode and Operators Point of Control).

The data base element in PIDCONA (or PIDCON) manages signal exchange between the PC function and the operators function. This provides the possibility of display presentation and event reporting of the signal for example, on passage of a preset alarm limit.

Scaling from process-related unit to the required electrical variable, before the output signal is delivered to the control circuit control device (valve), is performed in the AO unit.

2.3 The Configuration of a Control Circuit in Advant OCS

The basis for the configuration work is naturally knowledge of the function required which for example, can be documented in:

- P & I diagram (instrumented flow diagram)
- Instrument list
- Descriptions with curves and so on.

The dimensioning of, for example, the I/O required and the number of controllers required is the first step in the application programming of a process station. If it is assumed that this work is complete, the individual circuits can be configured in a few steps.

The structure of the control circuit with the functional units analog input, controller and analog output are shown in Figure 2-5.

A functional unit is a composite program function which in addition to the control function includes operators functions. For the controller, it is possible to compare with the traditional cassette controller, which embraces a control function on an electronics board and an operators panel with setting controls and instruments.

The following operations are to be performed and are illustrated in Figure 2-6:

In process station

1. Definition of individual input and output signals for the circuit
2. Definition of the controllers face to the operator
3. Definition of the control function required.

In operators station

1. Definition of process diagram display appearance and selection of dialog

If only a simple standard controller function is required, the required work is a minimum. The work to perform is described in more detail below.

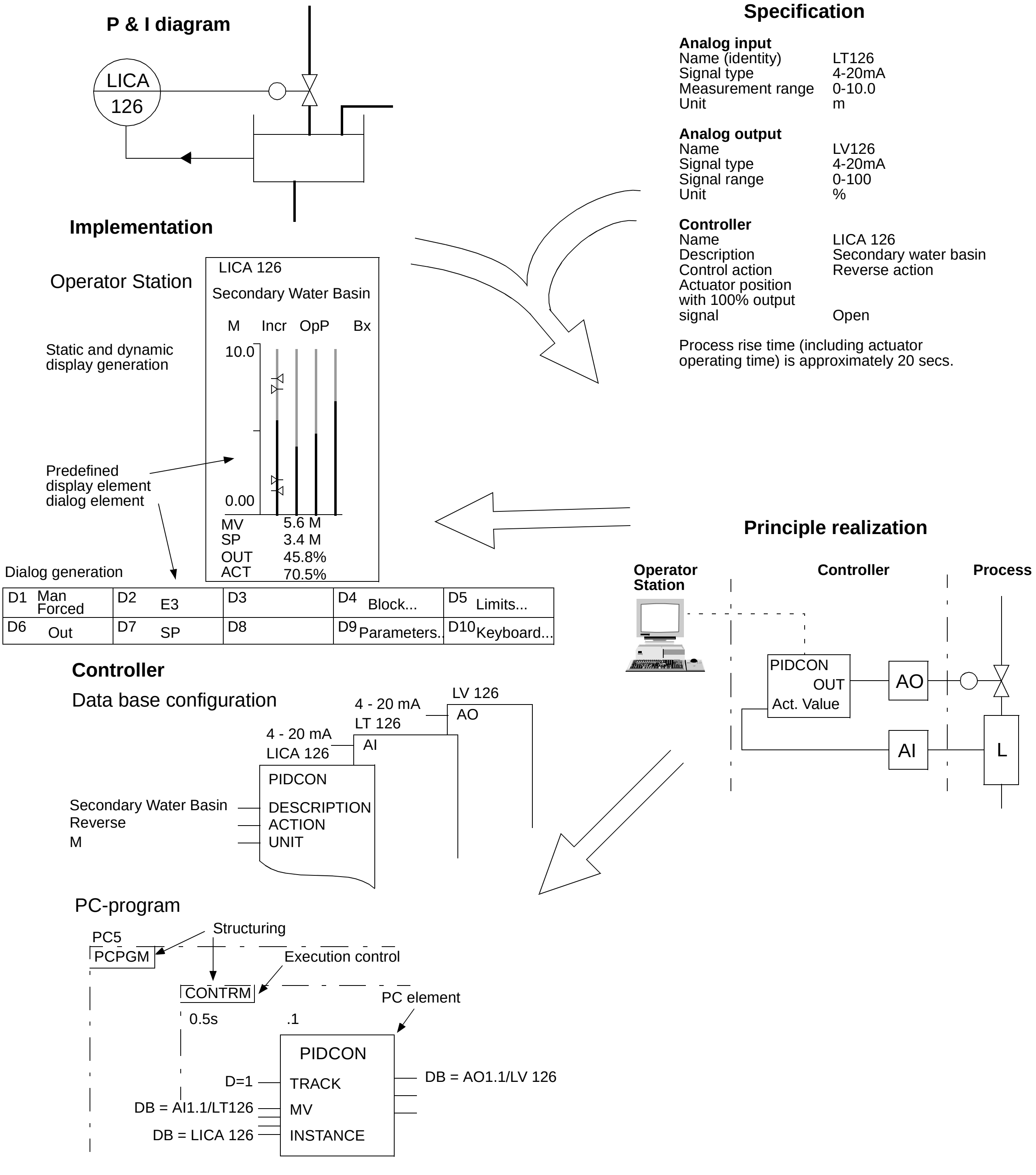


Figure 2-6. Sequence of configuration steps

2.3.1 Definition of Input and Output

The Engineering Tool is commanded to present the input and output, it is intended to utilize. For assistance, the Engineering Tool is provided with configuration displays and each instance has been given start values for all parameters. Normally, a few of these need adjustment. In the example, it is name (associated with the circuit), measurement range and signal type for the electrical signal. Alarm handling is not utilized in the AI, but the circuit alarm functions are centralized to the controller. When the signals are created in the process station, they are automatically presented on the operators station with object displays. To be utilized, for example, in fault tracing and simulation.

2.3.2 Definition of Controller Face to the Operator

This is performed in the same way as when the signals are created with the help of a configuration display. The start values are changed as required. Typical parameters to be defined are name, description, measurement range in process-related units, any limiting values and alarm limits. An automatic object display is thereby created in the operators station as well as an alarm handling with registrations in the event list and alarm list. Object display with max dialog permits adjustment of most of the parameters from the operators station.

2.3.3 Definition of Required Control Function

The control function is defined in a PC program in the structure created for the process station. For example in the PC program for "process section 5" under an execution - determining control module for the sampling time 500 ms.In the case of a simple controller function the function is solved with a single element of type PIDCONA/PIDCON. The connections of input and output signals are performed in the normal manner. Certain parameter values to determine are introduced. For example:

- Tracking function
- How the controller is to act at start after a voltage failure
- Ramp times.

This provides a functioning controller, which can be handled directly from an object display on the operators station.

2.3.4 Definition of the Process Diagram Display Appearance, and Selection of Dialog

Normally, the control loop is to be represented in different process diagram displays on the operators station. This is performed through display design with pre-prepared display elements, which includes subscription for all signals necessary. The appropriate dialog, max or min, is also determined in connection with the display design.

The operator can now operate the control loop from the process diagram display. This minimizes the need for display selection, while maintaining the overview.

2.3.5 Type Circuits

The basic way to create a complete control function as shown here can be further simplified and more effective through a Type Circuit handling, which is supported by Engineering Stations.

The Type Circuit is normally a large, repeated function in the installation. It may include several input and output signals from the process, several function units as well as the necessary application adaptation with PC elements. Only a few parameter values, which define the function of the individual circuits, can constitute the information exchange necessary between the process engineer responsible and the control program designer. The entry phase becomes very effective with respect to time. The Type Circuit library is often prepared to suit the project, but reuse from one project to another is natural (if possible).

2.4 Selection Guide

The different functional units are suitable for different ranges of application. A division, which can serve as a guide when selecting a suitable functional unit, has the following appearance.

2.4.1 DI, Digital Input

Digital Input from the process. Can be presented on the Operator Station with one of the displays (display element) or dialogues established for this unit. The object display is obtained automatically when the unit is implemented. The function contains, in addition:

- Updating (cyclic or interrupt)
- Filtering
- Inversion
- Event handling
- Error handling
- Simulation.

DI variant available:

- DI
- DI Event
- DI Calculated.

DI Event is a variant used for receive of external generated events.

DI Calculated is a variant which is available when handling and presentation of signals calculated in PC programs is required.

2.4.2 DO, Digital Output

Digital Output to the process. Can be presented on the Operator Station in the same way as Digital Input (DI).

The function does not include filtration, interrupt updating and event handling, but is otherwise in accordance with DI. There is the possibility of selecting restart value after a stop (for example after a supply voltage failure).

A variant (DO Calculated) is used with simple commanding from the Operator Station to the PC program.

2.4.3 AI, Analog Input (and pulse counter input)

Analog Input from the process. Can be presented on the Operator Station in the same way as DI. The function contains:

- Updating (cyclic)
- Filtering
- Dead zone
- Linearization
- Scaling
- Limit value control
- Event handling
- Error handling
- Simulation.

AI variants available:

- AI (current or voltage)
- Temp (Pt100)
- Thermocouple
- AI Event
- AI Calculated.

AI Event is a variant used for receive of external generated events.

AI Calculated is a variant which is available when event handling and presentation of signals calculated in PC programs is required.

Pulse counter input

The pulse counter input makes use of a digital input board (hardware) but the signal (channel, software) is processed as an analog signal. It is therefore possible to consider the pulse counter input as an analog input. The function thus contains the contents of AI except linearization, which is not required.

Advant Controller 410/450 contains a type of pulse counter board, type designation DSDP 110, which can be used for this type of functional unit. The system also supports other pulse counter boards used for positioning and frequency measurement.

2.4.4 AO, Analog Output

Analog output to the process. Can be represented in the operators station in the same way as DI.

The function has the same capabilities as AI except filtration, dead zone, linearization and event handling. It is possible to select a restart value after an interrupt for example after a supply voltage failure.

A variant AO Calculated, is used with simple reference generation from Operator Station to PC program.

2.4.5 GENBIN, User Defined Two Position Control

The control logic is to be defined and built up by the user.

The unit can be used as a tool to solve different control problems. The Advant Station 500 Series Operator Station function has however display and dialog which are adapted for control of motors and valves. The unit is therefore most suitable for control of this type.

2.4.6 GENUSD, User Defined Functional Unit

The PC program is to be defined and built up by the user. The Advant Station 500 Series Operator Station function has, as standard, a general display and dialog which permits use for both control functions and binary control. There are considerable possibilities available for the user to determine display and dialog.

2.4.7 GENCON, User Defined Regulator

The control function is to be defined and built up by the user. The Advant Station 500 Series Operator Station function has display and dialog which can be used for different control functions.

2.4.8 DRICONS and DRICONE

Functional units used to integrate standard or engineered drives. The drive is controlled and supervised from the Advant Controller 410/450. The drive can be controlled in different control modes and from different operator stations. The controller functions are realized in a type circuits and therefore easy to apply.

2.4.9 MOTCONI

Functional units for control and supervision of motors connected to a INSUM system. LONWORKS Network is used for communication between AC400 Series and INSUM.

The object can be controlled in different control modes and from different Operator Stations. The controller function is realized in a type circuit and therefore easy to apply.

2.4.10 SEQ, Sequential Control

A PC program including the sequence structure is to be defined and built up by the user. The sequence header, SEQ and the number of step elements STEP required are available for assistance. Automatic and manual stepping and freezing of the sequence is administered by the SEQ and STEP elements. The Advant Station 500 Series Operator Station function has display and dialog which is suitable for sequence control from the operator.

Conditions to be supervised and satisfied and the commands to be executed are built up by the user under the STEP element which builds up the sequence structure of the application. Conditions and commands can be designated step logic. Figure 2-7, and Figure 2-8 illustrates an example of a sequence structure.

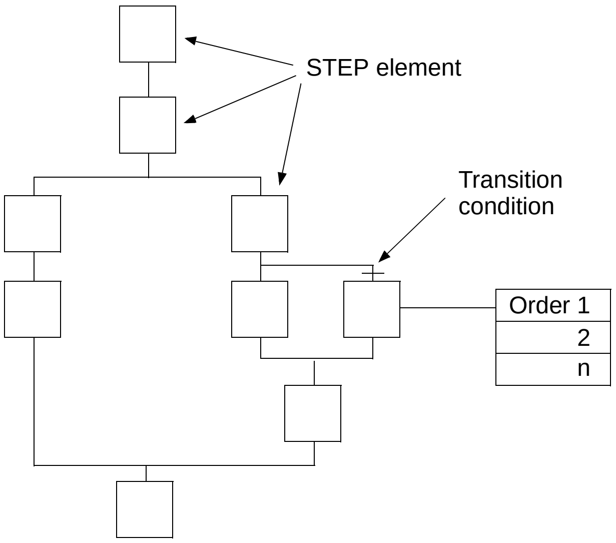


Figure 2-7. Sequence structure with divergence and convergence

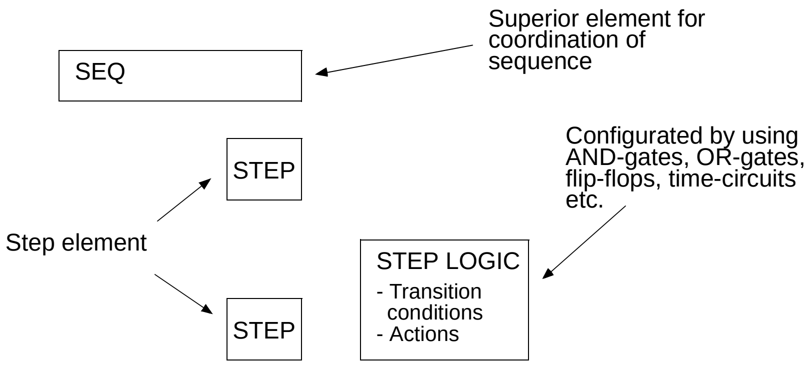

SEQ
Superior element for coordination of sequence
STEP
Configurated by using AND-gates, OR-gates, flip-flops, time-circuits etc.
Step element
STEP LOGIC
- Transition conditions
- Actions
STEP

Figure 2-8. Sequence structure Advant OCS

2.4.11 GROUP, Group Start

GROUP is a functional unit for group start of in the main motors and valves. The unit offers, in combination with a number of MOTCON and/or VALVECON functional units special display elements suitable for sequence starts.

The control function is to be defined by the user and is normally built up around the PC elements SEQ and STEP.

2.4.12 PIDCONA, Process Controller

Functional unit with fixed PC function. PIDCONA provides PID control with auto tuning and possibility for adaptive control (PIDCONA available in Advant Controller 450 only).

2.4.13 PIDCON, Process Controller

Functional unit with fixed PC function adapted to requirements set within the traditional process instrumentation.

2.4.14 RATIOSTN, Ratio Station

Used mainly together with a PIDCONA or PIDCON controller to achieve ratio control.

2.4.15 MANSTN, Manual Station

The unit has, in the same way as PIDCONA, PIDCON and RATIOSTN, a fixed PC function.

Used mainly as a reference generator for non controlled objects (position reference for control valves) or as a reference generator for external control equipment (for example convertors).

2.4.16 MOTCON and MOTCONI Motor Control

Functional unit for control and supervision of motors.

The object can be controlled in different control modes and from different Operator Stations. The PC function is fixed and therefore easy to apply.

2.4.17 VALVECON, Valve Control

Function unit for control and monitoring of valves.

In the same way as MOTCON, the object can be controlled in different control modes and from different Operator Stations.

Chapter 3 Common Properties

3.1 General

The functional units are characterized by a uniform philosophy. They are presented to the operator in a similar manner. You control the units from the keyboard using similar dialogs. Events and alarms are presented in event and alarm lists. You also use the units in your application work in a uniform way.

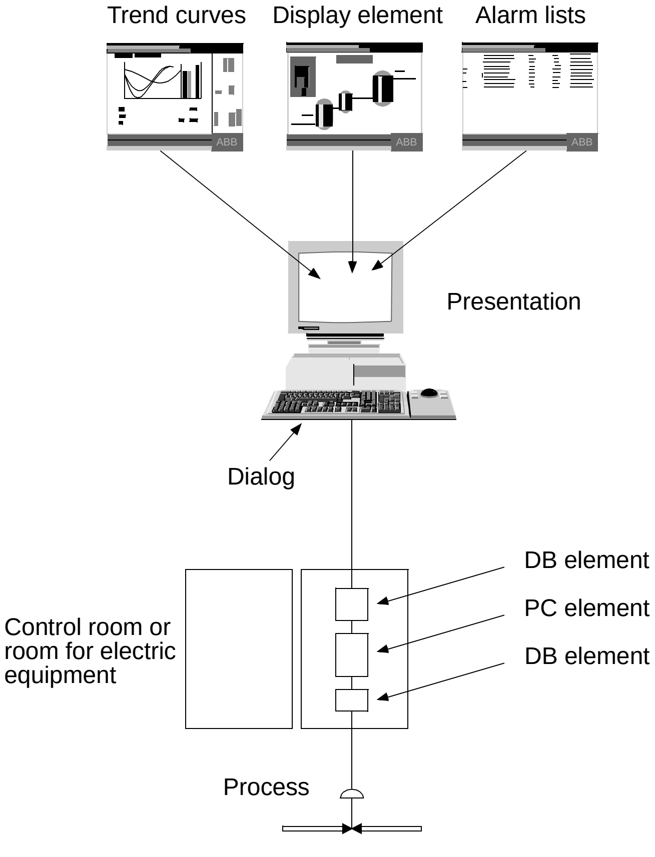


Figure 3-1. Survey of a functional unit

Each unit has display elements with several levels of detail, see Figure 3-2.

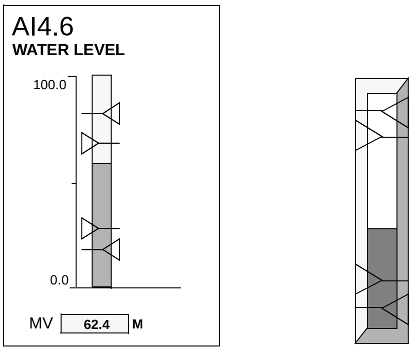
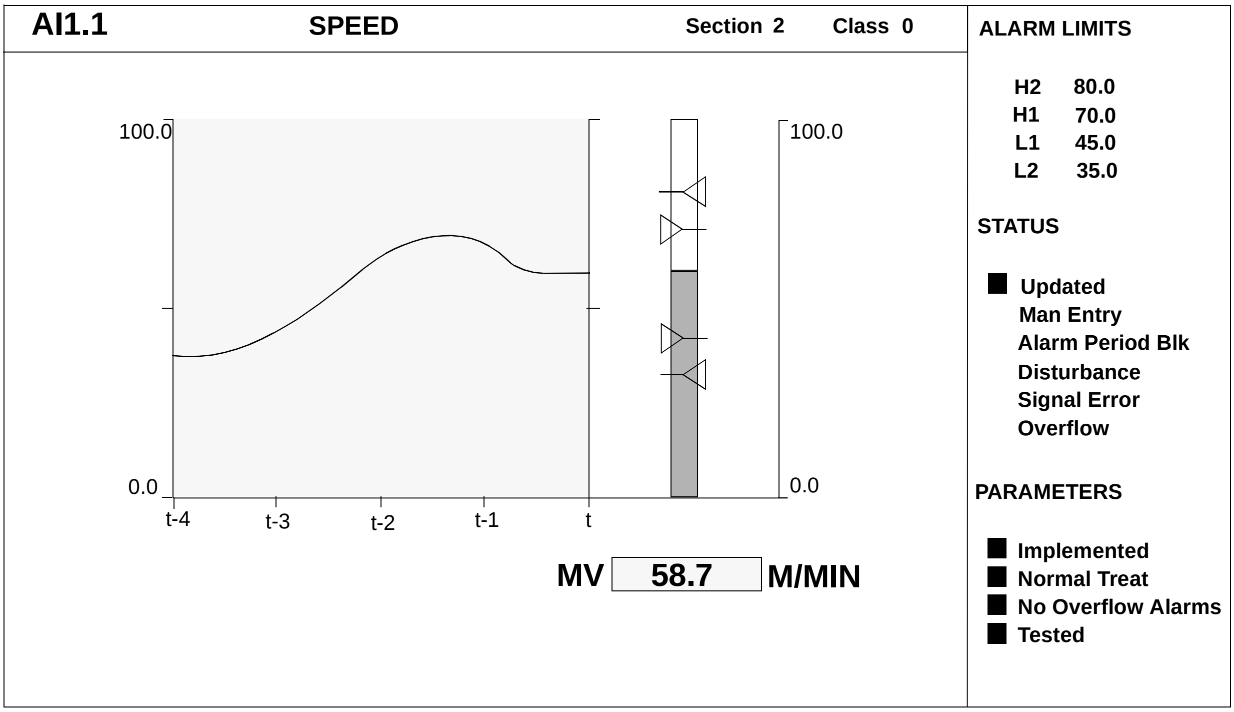


Figure 3-2. Display elements for an analog input



AI1.1 **SPEED** **Section 2** **Class 0**

MV 58.7 **M/MIN**

ALARM LIMITS

H2 **80.0**
H1 **70.0**
L1 **45.0**
L2 **35.0**

STATUS

■ **Updated**
Man Entry
Alarm Period Blk
Disturbance
Signal Error
Overflow

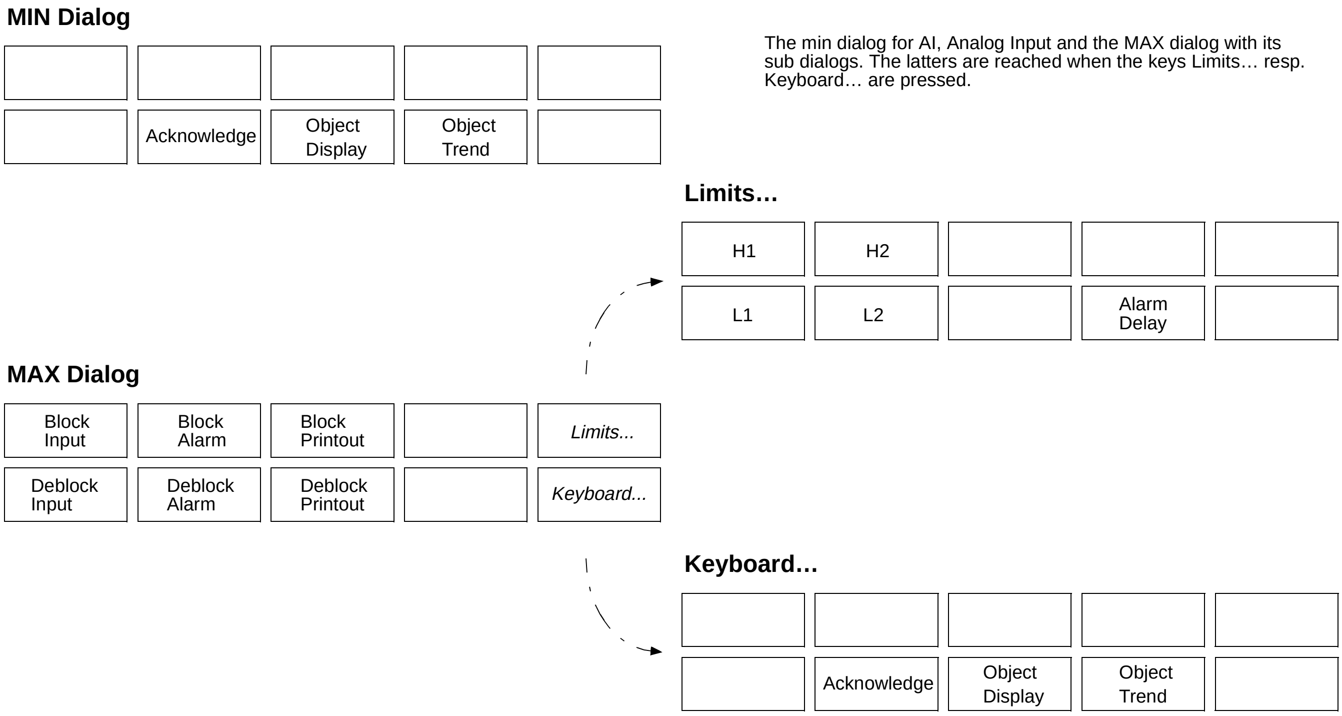
PARAMETERS

■ **Implemented**
■ **Normal Treat**
■ **No Overflow Alarms**
■ **Tested**

Figure 3-3. Object display for analog input

The process dialogs are divided into a **max** and a **min** detail level. The MIN dialog is intended for the operator whereas the MAX dialog is intended for maintenance.

The max display is locked by an authority key on the keyboard.

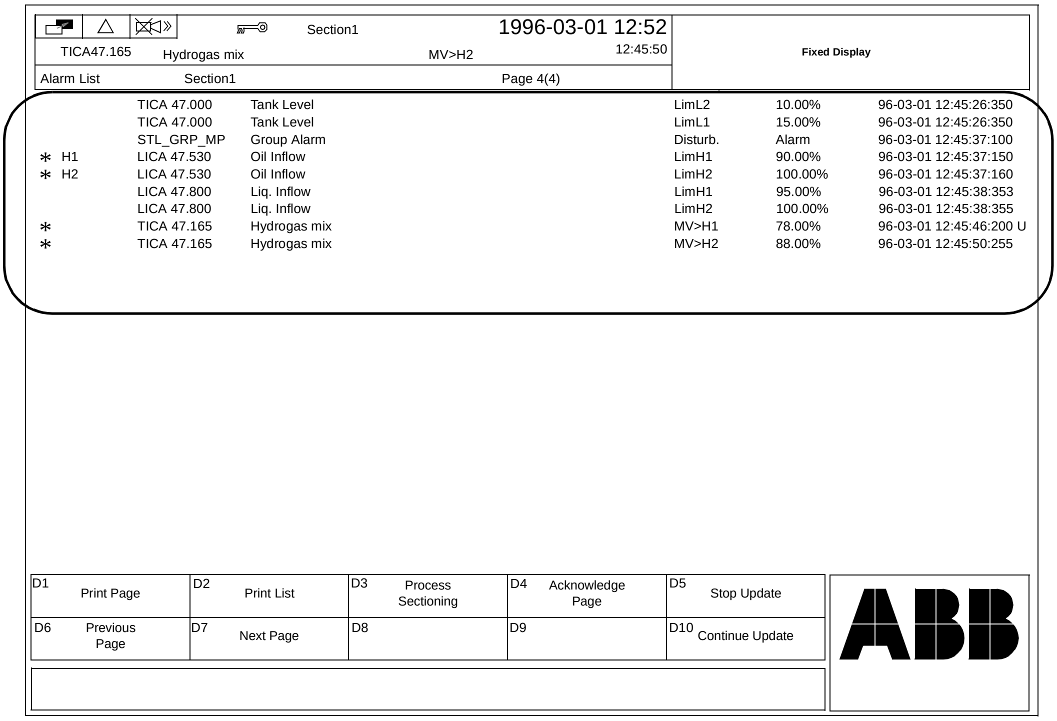


The min dialog for AI, Analog Input and the MAX dialog with its sub dialogs. The latters are reached when the keys Limits… resp. Keyboard… are pressed.

Figure 3-4. Analog Input dialogs

Certain status changes are defined as events in a functional unit. An event can be, for example, process indication, control mode change or a passage of a limit. An alarm is an event which requires acknowledgement.

The event registrations and alarms of a functional unit can be blocked and deblocked both by the operator and from the PC program. You can also change the texts to suit particular purposes.



```
TICA47.165   Hydrogas mix             MV>H2      1996-03-01 12:52
                                                         12:45:50
Alarm List           Section1                    Page 4(4)

          TICA 47.000   Tank Level      LimL2    10.00%    96-03-01 12:45:26:350
          TICA 47.000   Tank Level      LimL1    15.00%    96-03-01 12:45:26:350
          STL_GRP_MP    Group Alarm     Disturb. Alarm     96-03-01 12:45:37:100
*  H1     LICA 47.530   Oil Inflow      LimH1    90.00%    96-03-01 12:45:37:150
*  H2     LICA 47.530   Oil Inflow      LimH2    100.00%   96-03-01 12:45:37:160
          LICA 47.800   Liq. Inflow     LimH1    95.00%    96-03-01 12:45:38:353
          LICA 47.800   Liq. Inflow     LimH2    100.00%   96-03-01 12:45:38:355
*         TICA 47.165   Hydrogas mix    MV>H1    78.00%    96-03-01 12:45:46:200 U
*         TICA 47.165   Hydrogas mix    MV>H2    88.00%    96-03-01 12:45:50:255
```

Figure 3-5. Presentation in the event list

Certain signals within a functional unit are prepared for simple logging and presentation on trend displays. These can, for examples, be measured values, setpoints and output signals from a controller. Special signals can be logged via a calculating AI. Trend curves can be adjusted so that the scaling on the curve is only a part of the measurement range of the unit. The signals which are prepared for logging are described in the functional unit description, section Presentation, Time logged properties.

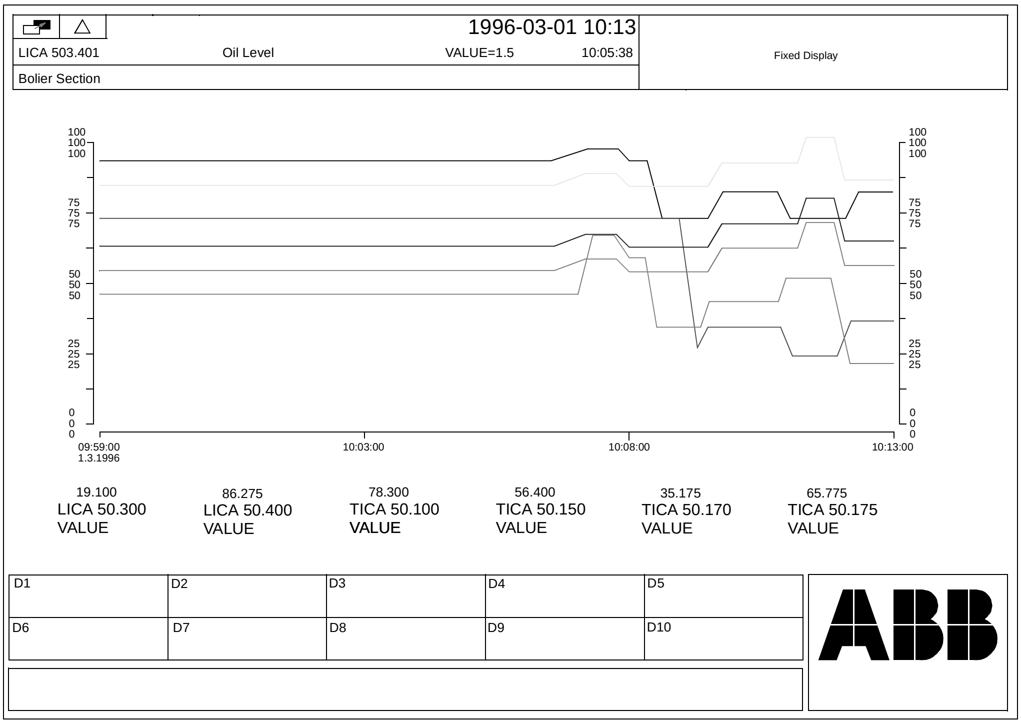


Figure 3-6. Examples of trend curves

You define object name, measurement range, certain presentations and event handling details and alarm levels in the data base. In addition, data base elements serve as an intermediate storage place for presentation, dialog and results from PC calculations. In brief, you determine in data base elements, the appearance of the operators communication for a single instance of a functional unit.

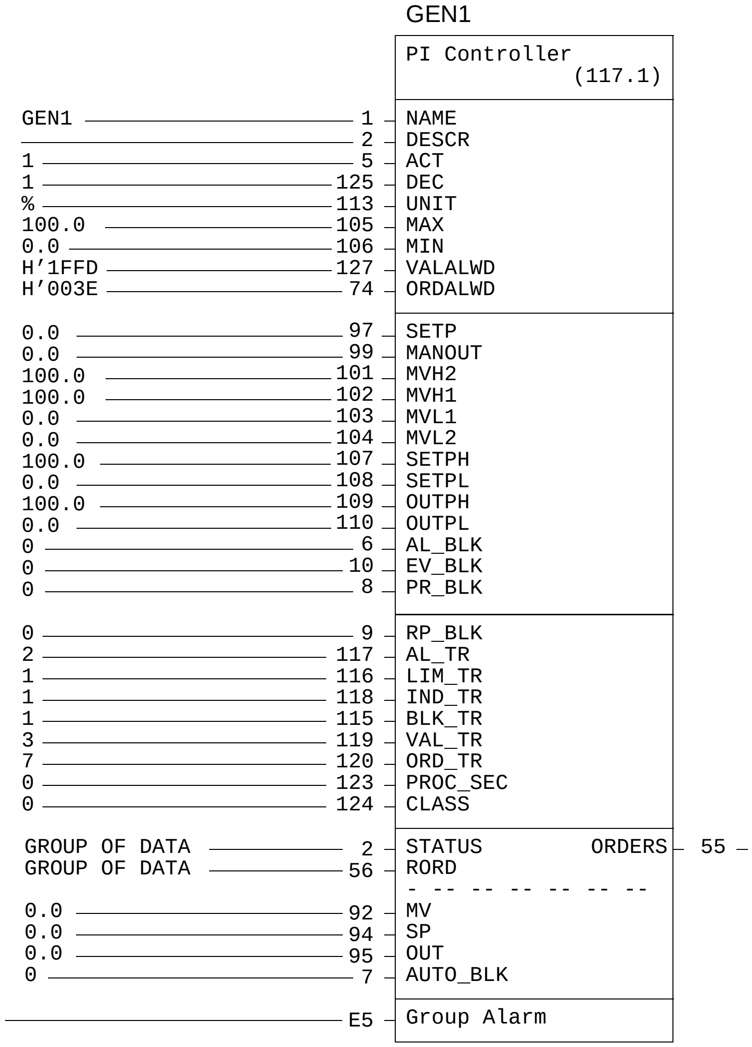


Figure 3-7. Data base element for GENCON

The survey of functional units, Figure 3-1, also contains a block of PC elements. The control or feedback control function is executed there if the functional unit has a functionally independent PC element (functional units of type 3). You adapt the size and function of the PC element to the requirements of the application with the help of parameters.

You link the data base elements, input signals, output signals and other PC elements when you make the PC program.

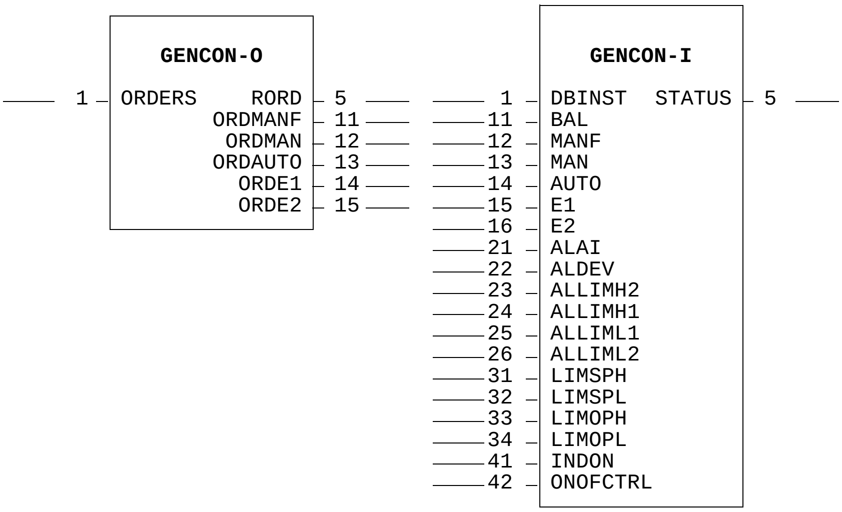


Figure 3-8. Two interface PC elements for GENCON

3.2 Presentation

A functional unit can be presented by means of display elements.

The following types of display elements are available:

- Process display element
- Group display element
- Object display element
- Trend display element.

3.2.1 Process Display Element

The process display element is intended for use in a process diagram display. The display element presents a measured value or status, error status and control mode. The object name is not included in the display elements as the process diagram display itself provides sufficient identification at a suitable place in the process diagram display.

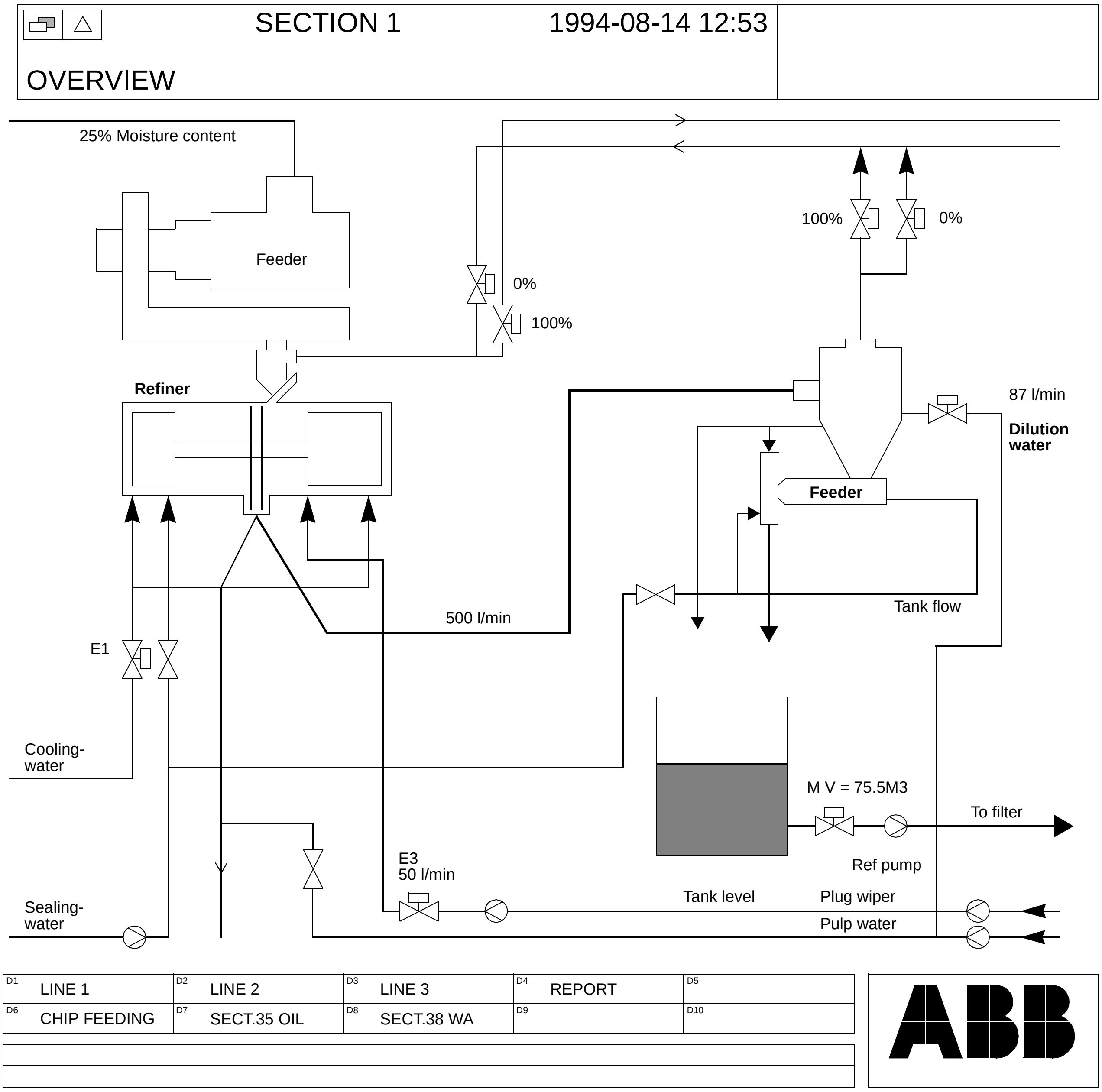


Figure 3-9. Example of process diagram display

You select an object in runtime by any of the following alternatives:

- Cursor position on the object symbol on the display
- Entry of the object name
- Curser positioned on the object name presented on the latest unacknowledged alarm line
- Use of the key "Prev. Object" on the operators keyboard.

The selection is confirmed by

- The object symbol gets a select area which is a white frame around the object
- The name, status and value of the object are presented in the dialog line
- A close up display of the object is displayed in the object close up area. See further Section 3.2.3, Object Display Elements.
- The dialog commands available for the object are presented in the dynamic function key area. If you press the key object display on the keyboard, a detailed display of the object is presented. See further Section 3.2.3, Object Display Elements.

You return to the process diagram display by pressing the "Previous display" key on the keyboard.

A small selection of process display elements are shown in below in Figure 3-10.

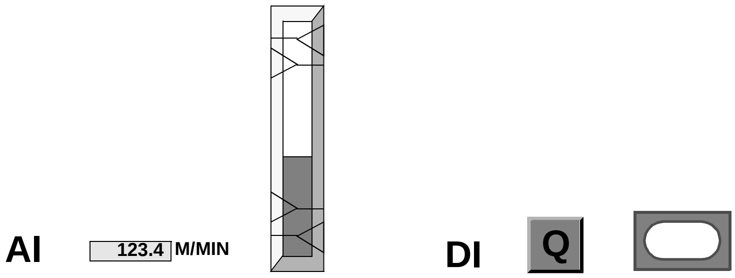


Figure 3-10. Examples of display elements for process diagram displays

3.2.2 Group Display Elements

A group display consists of up to ten group display elements.

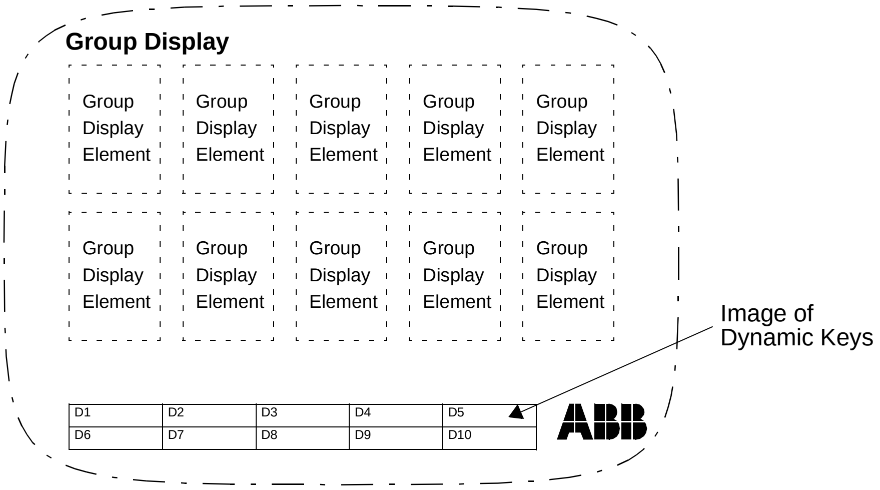


Figure 3-11. Group display layout on operators screen

The group display element describes the object in more detail, for example, the setpoint and output signal of a controller are presented in addition to the measured value. The error status is also presented in detail and not only as a collective flag.

An example could be a process diagram display with some parallel pumps. Each pump has a motor, several associated valves, pressure and flow rate meters and thermometers. Measured values and status of all pumps are presented in the process display. In the group display for individual pumps, there is a detailed presentation of speed or flow rate control, pressure and temperature and valve status for each single pump line.

Two examples of group display elements are presented below in Figure 3-12.

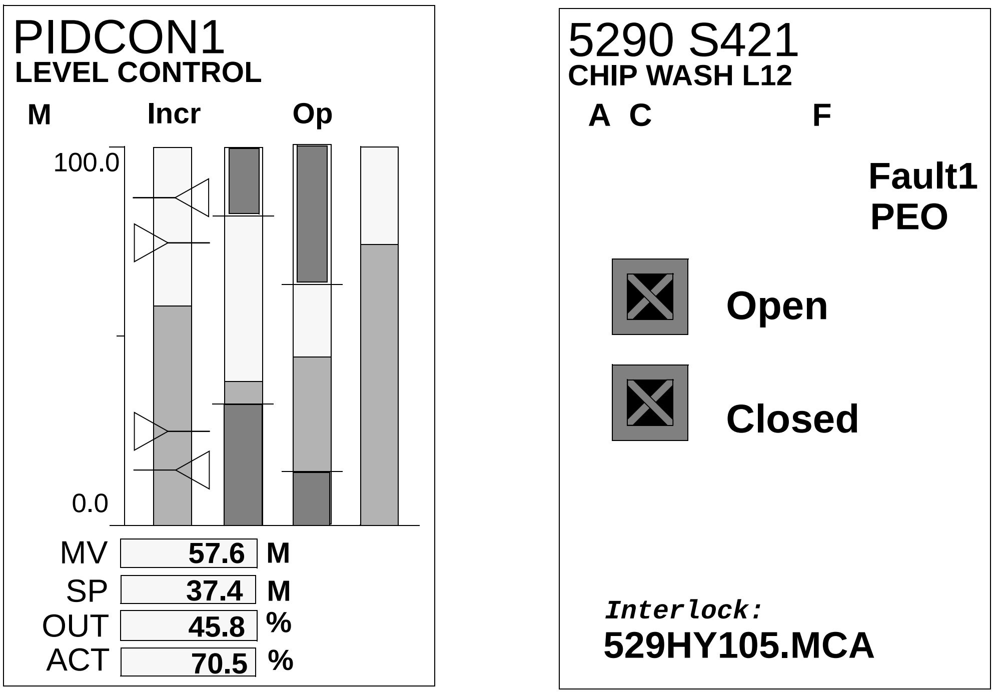


Figure 3-12. Examples of display elements for group displays

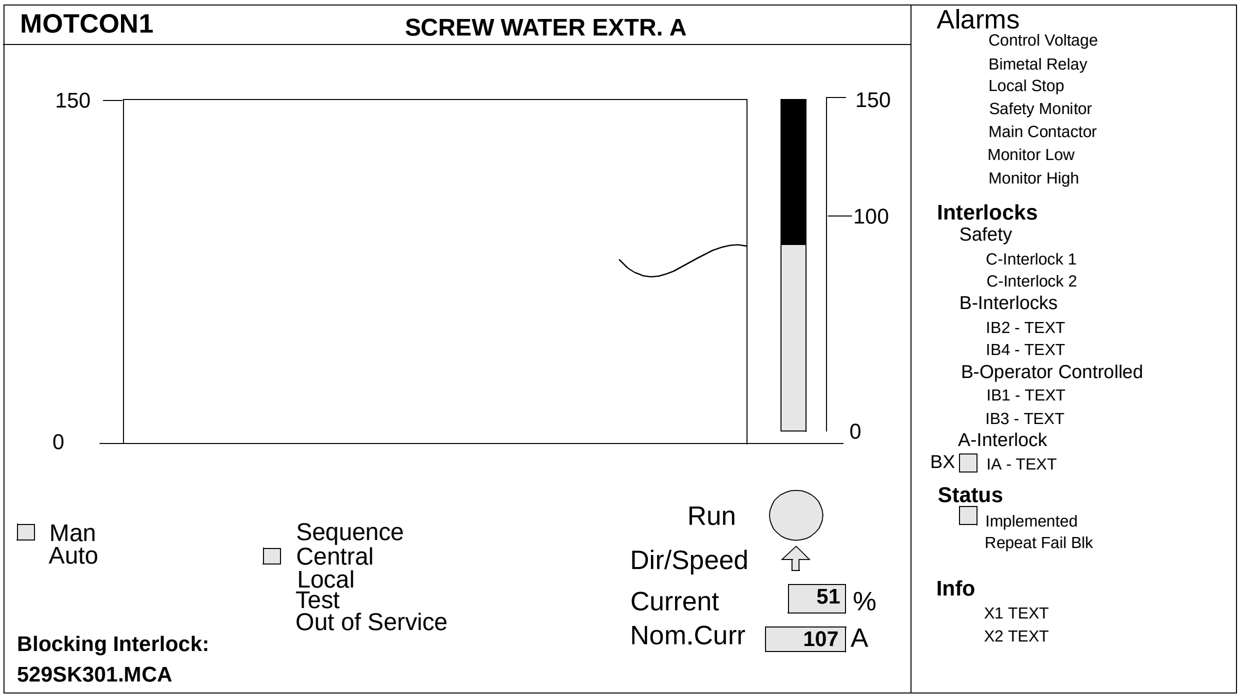
3.2.3 Object Display Elements

Object Display

The object display element is the most detailed presentation of a functional unit. When a data base element of a functional unit is created, an object display element is automatically generated. The display element can be presented as a base display occupying the whole display area or it can be presented as an overlap display covering a part of the presented base display.

The object display is used when details for a functional unit/process object are to be indicated and/or changed, keeping all details in view. This can apply to alarm limit setting, alarm blocking or control parameter tuning. The object display contains a trim curve which can be used when tuning a controller.

If the object is selected you press the key “Object” to get the object display as a base display. Press “Object” and “Shift” simultaneously to get the object display as an overlap display.



Current 51 %
Nom.Curr 107 A

Blocking Interlock:
529SK301.MCA

Figure 3-13. Examples of normal object display MOTCON

Close-up Display

A close-up object display contains all the information and control possibilities which an operator normally needs in day-to-day work with the system. For a controller, the information can be measured values, setpoint, output signals in numerical form and in staple form, the current control mode and details about alarms.

For motor control, the control mode and other functional status and user defined texts for the operational status of the circuit and any interlocking are shown.

The close up display is automatically presented when an object is selected. The close-up display is presented in a field reserved for this purpose in the lower right hand corner, together with the dialog for the object.

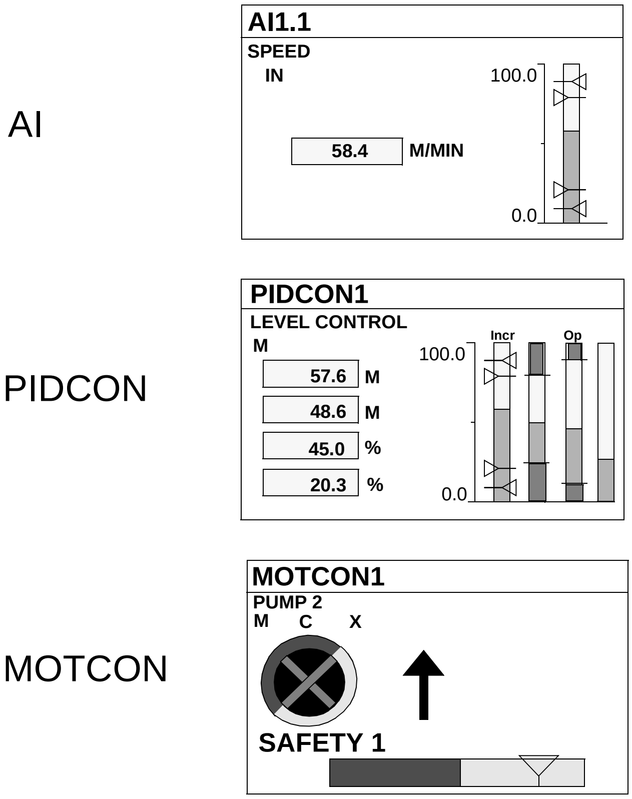
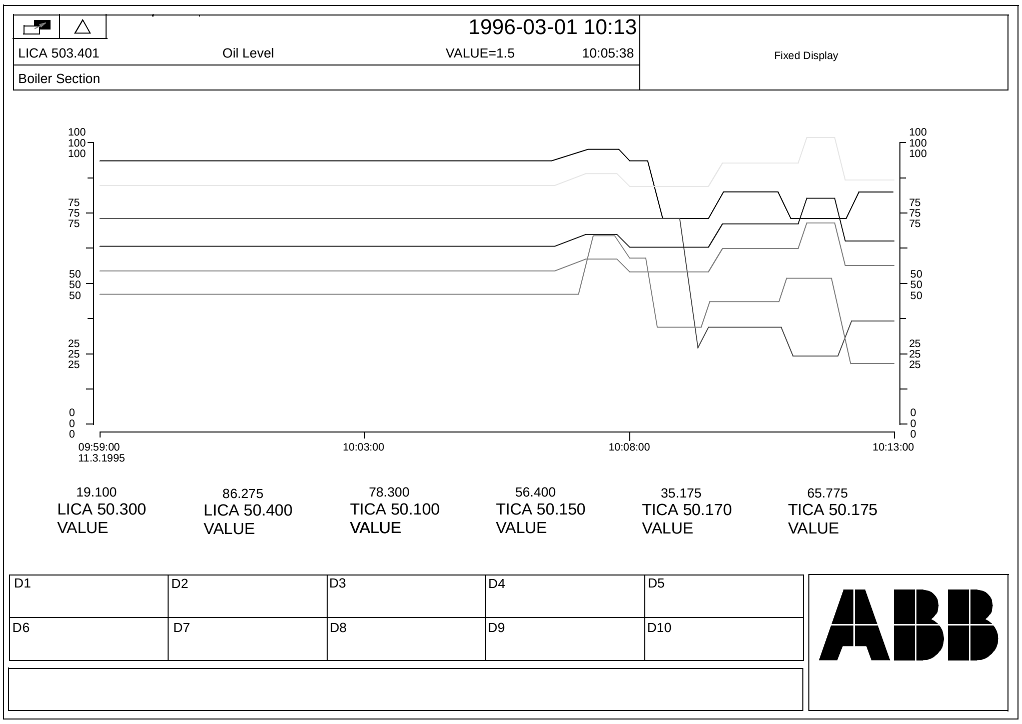


Figure 3-14. Examples of object close-up display

3.2.4 Trend Display Element

A trend display presents logged values of a signal in a functional unit. The appearances of the trend data logs are determined, when the process station is dimensioned. You can determine

- Number and size of the logs
- Number of variables
- Time intervals between the samplings and logging.
- If the value logged is to be a momentary value or a maximum, minimum or mean value of those sampled during the logging interval.



1996-03-01 10:13

LICA 503.401 Oil Level VALUE=1.5 10:05:38

Fixed Display

Boiler Section

19.100 LICA 50.300 VALUE

86.275 LICA 50.400 VALUE

78.300 TICA 50.100 VALUE

56.400 TICA 50.150 VALUE

35.175 TICA 50.170 VALUE

65.775 TICA 50.175 VALUE

Figure 3-15. Examples of trends

The signals, which can be logged in a functional unit, are listed in each individual functional unit description section: Presentation, and Time-logged properties. How trends and logs are defined and adjusted is described in other Advant Station 500 Series Operator Station manuals.

3.2.5 Display Design and Display Updating in Brief

You create your displays using AdvaBuild Display Builder software option. The displays are comprised or static graphical information and dynamic objects (display elements). The updating of the display elements are as follows:

- Demand
- Demand + event
- Demand + event + update each 9 seconds
- Demand + event + update each 3 seconds
- Demand + event + update each 1 second.

Update every 9th seconds is default and is suitable for functional units without analog values.

From the point of view of capacity, updating more frequent than necessary should not be requested. The user may subsequently judge how often the analog values are to be updated, each second, third or ninth second. This selection is based largely on the nature of the application and in which display the functional unit instance is used.

Note that different updating types can be selected for different individual display elements within a display.

In the manual *AdvaBuild Display Builder User’s Guide* you are given more information about how to create and change displays.

3.3 Dialog

The dialog is the operators tool when controlling/operating a functional unit.

When an object is selected, you can set (using the Dynamic Function Keys):

- Control modes
- Alarm limits
- Blockings
- Setpoints
- Control parameters.

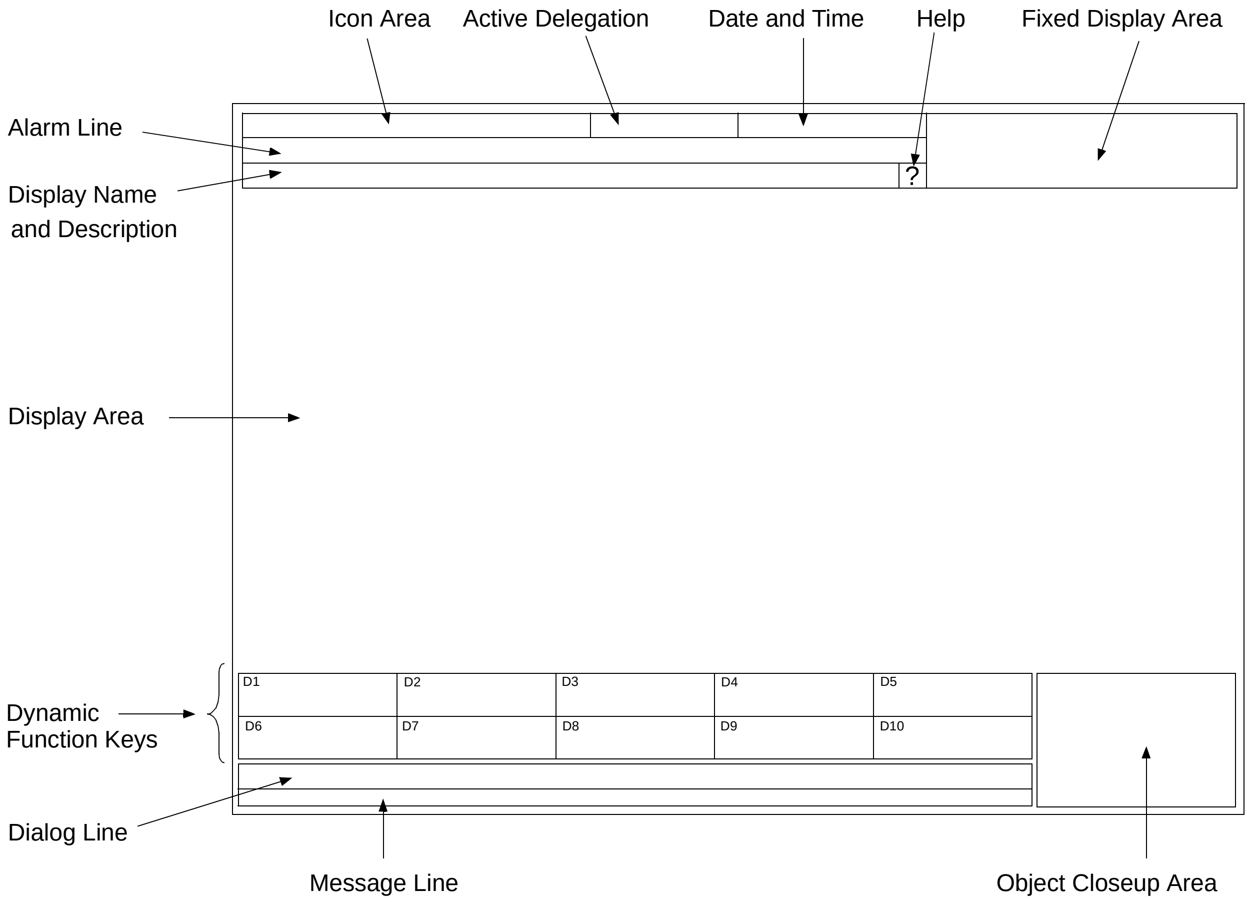


Figure 3-16. Basic Screen Layout

With **no object selected**, the dialog "belongs" to the display. You use this dialog to exchange displays on the Display Area.

A process diagram display can have other closely related or associated process diagram, which you easily reach by using the dialog keys. Only the dialogs of functional units are described here.

D1	D2 Boiler 1	D3 Boiler 2	D4 Tank	D5 Pump
D6	D7	D8	D9 Report	D10

Figure 3-17. Example of a dialog for a user designed dynamic display selection

With **an object selected**, the dialog is related to that object. Each functional unit has some specific display elements, related to that specific function unit. This means, that the MAX and MIN dialog for different functional units differs. The following four figures gives examples related to a PIDCON display element (for further information see the manual *AdvaCommand User Interface Reference Manual*).

The MAX dialog is particularly intended for maintenance and the MIN dialog is intended for operators. The MAX dialog is locked with a keyboard key. This must be in its unlocked position, if the MAX dialog is to be obtained.

The purpose of having a MAX and MIN dialog is to provide the instrument technician and the operator dialogs appropriate to the work they are to perform, for example setpoint, control modes and start and stop belong to the MIN dialog. In addition to the functions included in the MIN dialog the MAX dialog also contains alarm limits, blockings, simulations and parameter adjustments.

Some dialogs have “subdialogs”. Each level of dialog keys are limited to ten dynamic keys. This limitation is eliminated by one key opening further ten keys on a lower level (“subdialogs”). The operator goes down or climbs on a dialog tree. Typical examples are parameter adjustments, limit value adjustments, blockings, and control modes. Keys designated with “...” at the end of the name, for example “Block ...”, “Limits ...”, “Parameters ...”, and “Keyboard ...”, are provided to open “subdialogs” on a lower level.

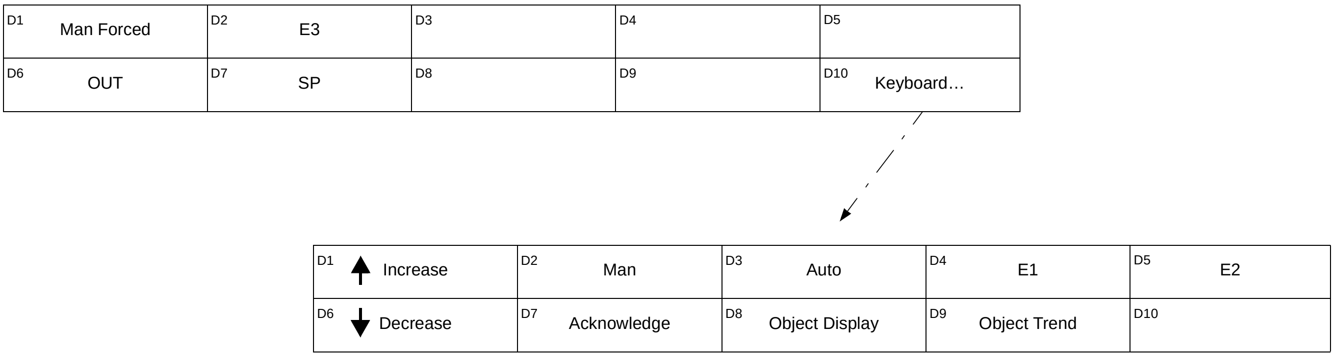
D1 Man Forced	D2 E3	D3	D4	D5
D6 OUT	D7 SP	D8	D9	D10 Keyboard…

Figure 3-18. MIN dialog for the PIDCON display element

D1 Man Forced	D2 E3	D3	D4 Block…	D5 Limits…
D6 OUT	D7 SP	D8	D9 Parameters…	D10 Keyboard…

Figure 3-19. MAX dialog for the PIDCON display element

A dialog can have “subdialogs”. Figure 3-20 below presents an example of a MIN dialog and its subdialog.

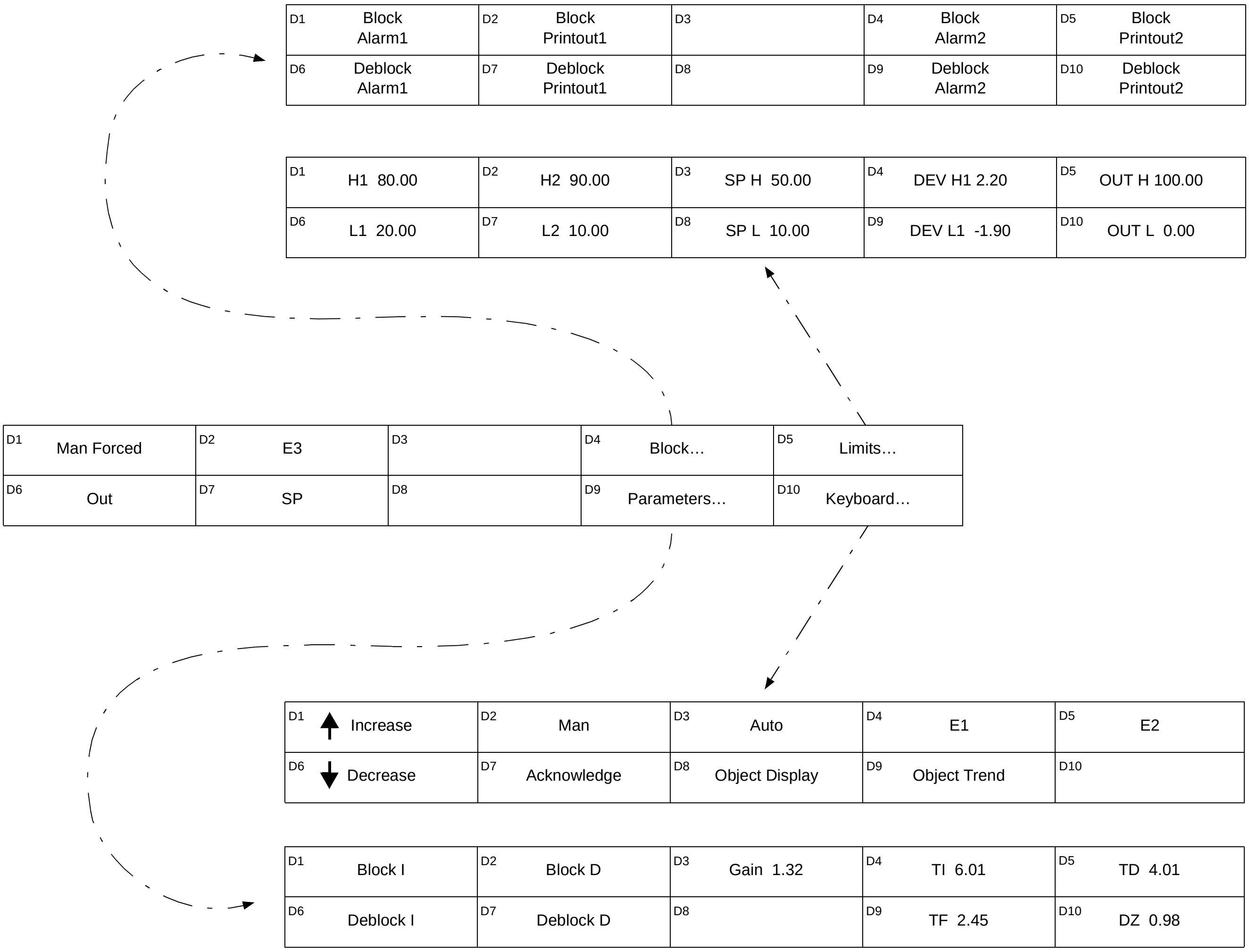


D1 Man Forced	D2 E3	D3	D4	D5
D6 OUT	D7 SP	D8	D9	D10 Keyboard…

D1 ↑ Increase	D2 Man	D3 Auto	D4 E1	D5 E2
D6 ↓ Decrease	D7 Acknowledge	D8 Object Display	D9 Object Trend	D10

Figure 3-20. MIN dialog with the relevant subdialogs for PIDCON

Figure 3-21 presents an example of a MAX dialog and its subdialogs.



D1 Block Alarm1	D2 Block Printout1	D3	D4 Block Alarm2	D5 Block Printout2
D6 Deblock Alarm1	D7 Deblock Printout1	D8	D9 Deblock Alarm2	D10 Deblock Printout2

D1 H1 80.00	D2 H2 90.00	D3 SP H 50.00	D4 DEV H1 2.20	D5 OUT H 100.00
D6 L1 20.00	D7 L2 10.00	D8 SP L 10.00	D9 DEV L1 -1.90	D10 OUT L 0.00

D1 Man Forced	D2 E3	D3	D4 Block…	D5 Limits…
D6 Out	D7 SP	D8	D9 Parameters…	D10 Keyboard…

D1 ↑ Increase	D2 Man	D3 Auto	D4 E1	D5 E2
D6 ↓ Decrease	D7 Acknowledge	D8 Object Display	D9 Object Trend	D10

D1 Block I	D2 Block D	D3 Gain 1.32	D4 TI 6.01	D5 TD 4.01
D6 Deblock I	D7 Deblock D	D8	D9 TF 2.45	D10 DZ 0.98

Figure 3-21. MAX dialog with the relevant subdialogs for PIDCON

Direct Access Keys

The following are brief comments on a number of fixed keys:

- On and Off for valves, switches, motors, pumps etc.
- Change mode of the controllers: Man, Auto, E1 and E2
- Change a value by ramping up or down. The Increase/Decrease is change one percent of the present value. If you press <Shift> simultaneously, the change is 10 percent.

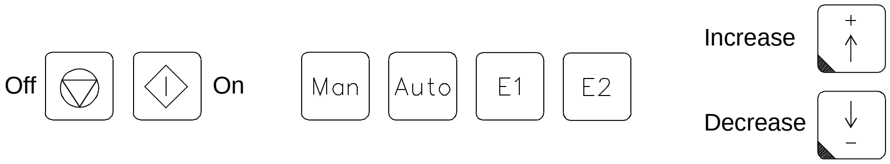


Figure 3-22. Direct Access Keys

For example of how to use these direct access keys, see Section “Methods for Process Objects” in the manual *AdvaCommand Basic Functions User’s Guide*.

For the general object GENXXX and MOTCON, VALVECON, individual keys can be blocked easily with the help of the data base element. This can be convenient when certain control modes should not be available to an operator. In the case of PIDCON, similar blocking can be performed with the help of the PC element. See further under the different functional units.

3.4 Event Handling

3.4.1 Events and Alarms

A number of status changes are defined as events for each type of functional unit. These include control mode exchange, tripped process interlocking, a binary signal which changes status in relation to a defined normal status, passage of a limit, signal error, start of a sequence and end of a sequence.

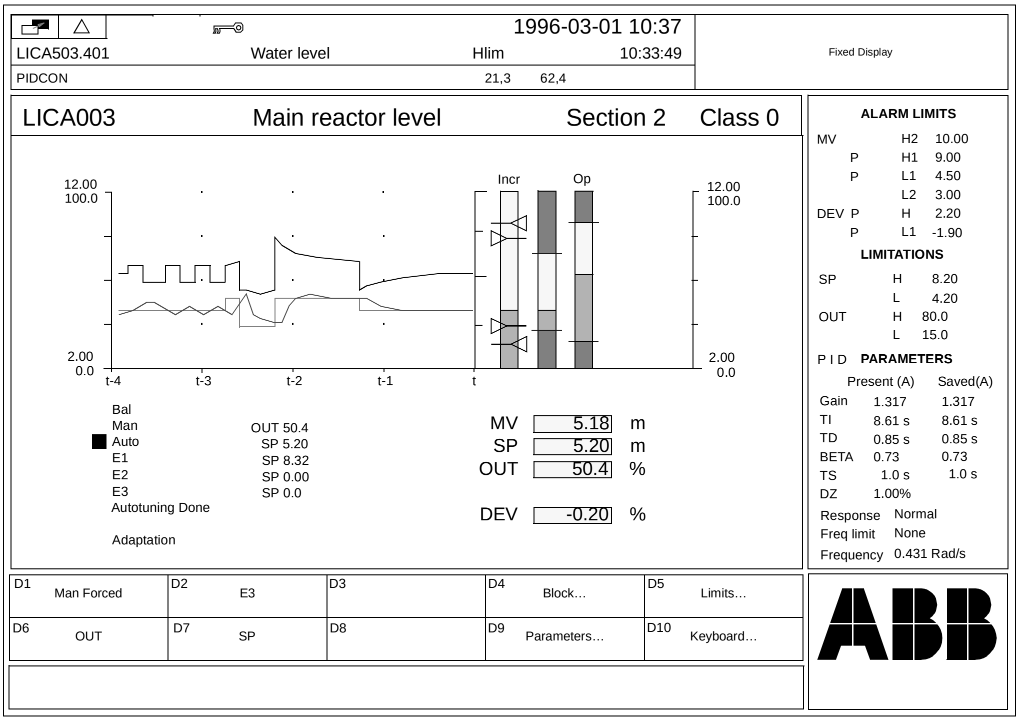
All events are time-tagged. Alarms are a special type of event which must be acknowledged. This means that the alarm remains flashing in the alarm list and in display elements, even if the alarm status has disappeared, until the operator acknowledges the alarm. On acknowledgement, the flashing changes to a steady illumination if the alarm/fault remains or disappears otherwise.

Certain defined events such as passage of a limit can be treated, individually for each functional unit applied, as an alarm, an event not requiring acknowledgement or can be completely ignored. Other events cannot be handled as alarms. These are described in the different functional unit descriptions.

3.4.2 Presentation

An event can be presented in different ways in a functional unit:

- Color change of a text or symbol in a display element
- Change of a symbol in a display element
- Addition to the text in a display element
- Text in the last unacknowledged alarm line at the top of a display
- New line or the removal of a line in the alarm list
- New line in the event list.
- New printout on the alarm and event printer
- Color change of a text in the object display for the Group Alarm object.



1996-03-01 10:37

LICA503.401 Water level Hlim 10:33:49

PIDCON 21,3 62,4

Fixed Display

LICA003 Main reactor level Section 2 Class 0

Bal
Man
■ Auto
E1
E2
E3
Autotuning Done

Adaptation

OUT 50.4
SP 5.20
SP 8.32
SP 0.00
SP 0.0

MV 5.18 m
SP 5.20 m
OUT 50.4 %

DEV -0.20 %

ALARM LIMITS

MV		H2	10.00
	P	H1	9.00
	P	L1	4.50
		L2	3.00
DEV	P	H	2.20
	P	L1	-1.90

LIMITATIONS

SP	H	8.20
	L	4.20
OUT	H	80.0
	L	15.0

P I D PARAMETERS

	Present (A)	Saved(A)
Gain	1.317	1.317
TI	8.61 s	8.61 s
TD	0.85 s	0.85 s
BETA	0.73	0.73
TS	1.0 s	1.0 s
DZ	1.00%	

Response Normal
Freq limit None
Frequency 0.431 Rad/s

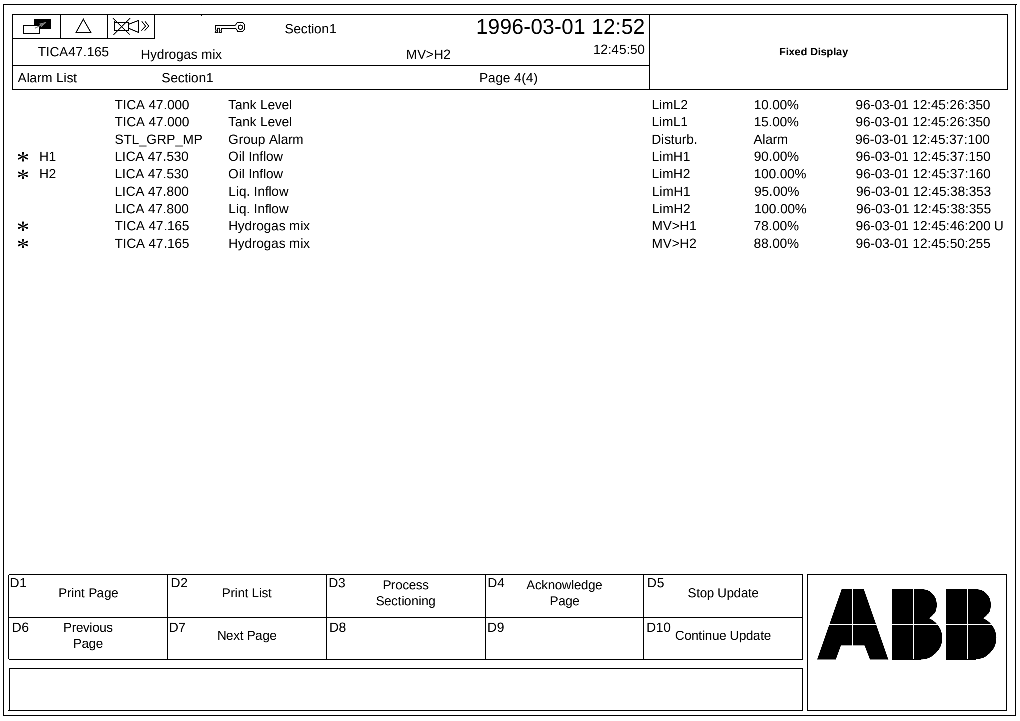
Figure 3-23. PIDCONA Element

Beside the previously mentioned alarm and event presentation, you can select external alarm for the objects at the configuration. When the object goes to an alarm status, either a load speaker in the keyboard or an output on a DO board is activated. It is easy to associate "events" with digital outputs or other program functions because the PC elements of each functional unit have outputs for events (such as the passage of alarm limits).

Events can be blocked in different ways, automatically via a program function or manually from the operators keyboard. This is described further in Section 3.9, Alarm and Event Blocking.

3.4.3 Presentation of Alarms and Events

Presentations in event and alarm lists have the following typical appearances.



```
                                    Section1            1996-03-01 12:52
  TICA47.165     Hydrogas mix                 MV>H2             12:45:50
Alarm List         Section1                         Page 4(4)

                TICA 47.000   Tank Level        LimL2      10.00%    96-03-01 12:45:26:350
                TICA 47.000   Tank Level        LimL1      15.00%    96-03-01 12:45:26:350
                STL_GRP_MP    Group Alarm       Disturb.   Alarm     96-03-01 12:45:37:100
*  H1           LICA 47.530   Oil Inflow        LimH1      90.00%    96-03-01 12:45:37:150
*  H2           LICA 47.530   Oil Inflow        LimH2      100.00%   96-03-01 12:45:37:160
                LICA 47.800   Liq. Inflow       LimH1      95.00%    96-03-01 12:45:38:353
                LICA 47.800   Liq. Inflow       LimH2      100.00%   96-03-01 12:45:38:355
*               TICA 47.165   Hydrogas mix      MV>H1      78.00%    96-03-01 12:45:46:200 U
*               TICA 47.165   Hydrogas mix      MV>H2      88.00%    96-03-01 12:45:50:255
```

Figure 3-24. Alarm List Layout

3.4.4 Function Selection

Special parameters are important for the event handling. These parameters are mentioned in many Advant OCS documents under the collective designation “Event-Treat-pointers”. They are used, for example, to determine whether a change of status is to be handled as an alarm or an event. It is also possible to determine color priority and whether an acoustic signal is to be activated, separate handling of changes 0 to 1 and 1 to 0 and so on. The text content in an alarm line can, within certain limits, be adjusted for a functional unit instance.

Different types of events in a functional unit are assembled in groups, which are allocated a pointer, with which you determines the event handling of the group. Thus, for example, signal errors in an analog input are collected in a group with a pointer ERR_TR. Passages of limits “Low” and “High” (L1 and H1) are another group with a pointer LIM1_TR. A third group of passages of limits “Low low” and “High high” (L2 and H2) have a pointer LIM2_TR. The event handling, within a group, is the same in principle, but each individual event has its own text in the presentations.

Each pointer has been allocated a default value on delivery (a norm value). In many cases this selection is satisfactory and permits you to start the Advant OCS system without further adjustment.

The Event-Treat-pointers are located in the data base element for the different functional unit. Figure 3-25 shows the pointers for an analog input. The pointers here have the value 0, which means that all event handling is blocked.

The pointers are otherwise given a number, which points out a standard alarm and event handling description (an Event Treat data base element in the Operator Station).

The Event Treat pointers 1-16 are, with a standard handling, ready for use and cannot be changed. The Pointers 17-19 are spare pointers for future permanent Event Treat. Event Treat pointers 20-300 can be used by the user, without restriction, to adapt the event handling to the requirements of the process concerned.

Standard pointers adapted to the individual type of the functional unit is given in the functional unit description (in subsection “Event description with standard texts” in section “Event Handling”).

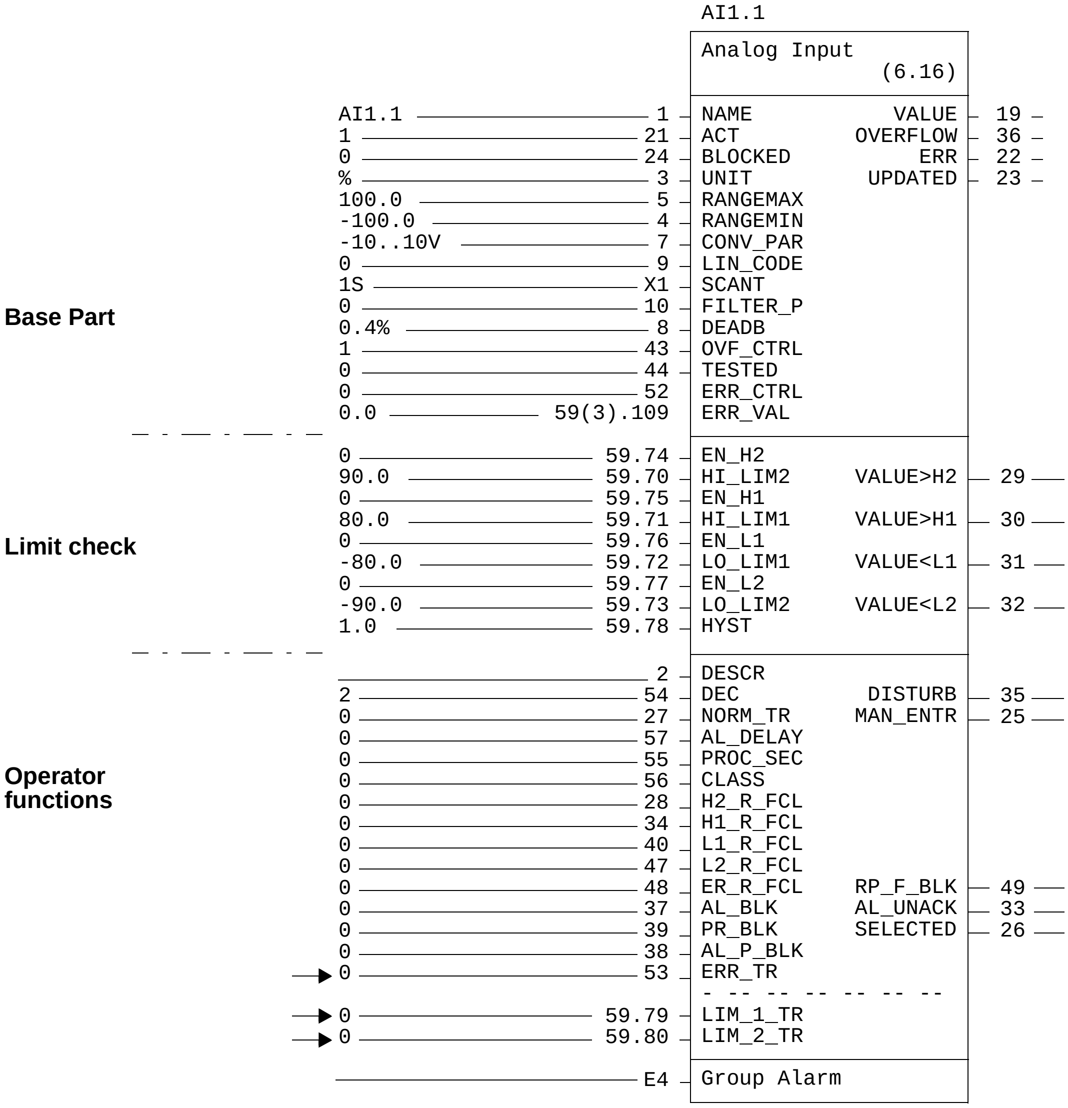


Figure 3-25. Data base element AI with Event-Treat-pointer

The function obtained by standard pointers can be described generally:

Table 3-1. Functions obtained by standard pointers

Pointer for	Req. of acknowl.	Audible signal	Print-out color	Print-out in Event list		Print-out in Alarm list	
				enter	leave	enter	leave
Event	no	no	green	yes	yes	no	no
Event+Alarm	yes	Keyboard	red	yes	yes	yes	no

Figure 3-26 presents a symbolic picture of an event handling with user defined event and alarm texts, that is Event Treat pointer number 20.

The function can be described:

The event "value >H2" is detected in the PC element or in connection with AI in the signal processing. The event is transmitted to the data base element, where it is stored. Preparations are made for a transmission to the Operator Station at the same time. The Advant Station 500 Series Operator Station is informed that the event has occurred and in which way it is to be processed (Event-Treat-pointer = 20). The Operator Station checks the Event Treat number 20, and transmits the event to the display screen and printer in the manner described in the file.

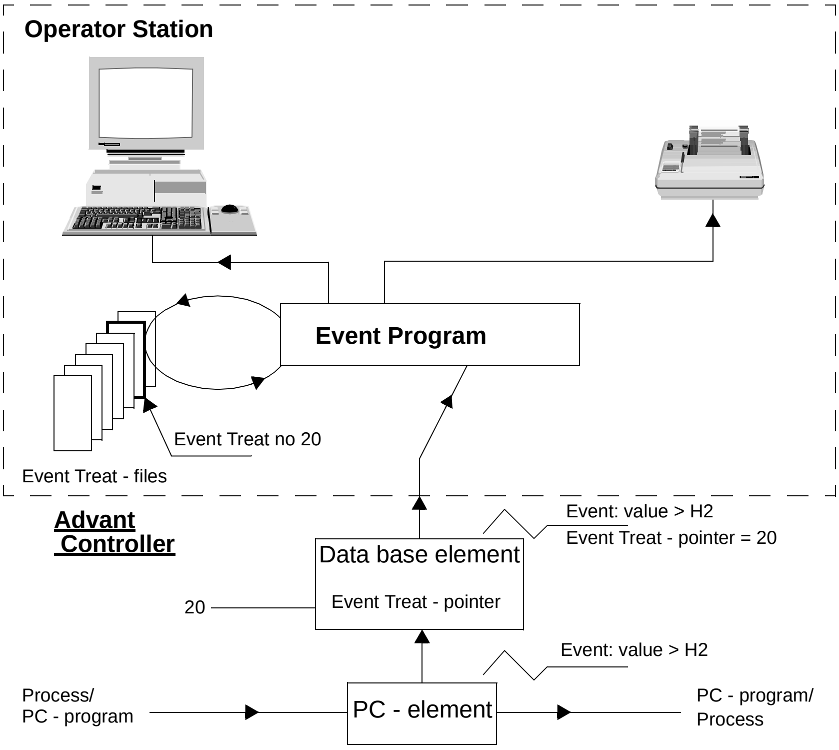


Figure 3-26. Symbolic display of an event handling

The user sets the required parameter values in Event Treat concerned with the help of data base elements in the Operator Station. Figure 3-27 shows the appearance of the element.
The functions from which a selection can be made include:

- Acoustic alarm in keyboard or external signal device (siren) via a digital output.
- Color priority.
- Alternative handling at changeover from normal to alarm status and vice versa.
- Selection between alarms in the process diagram only or in both diagram and in lists.
- Text layout for presentation in lists and new pointers to user-defined text.

For detailed information regarding alarm and event handling, see the manual *AdvaCommand Basic Functions User’s Guide*.

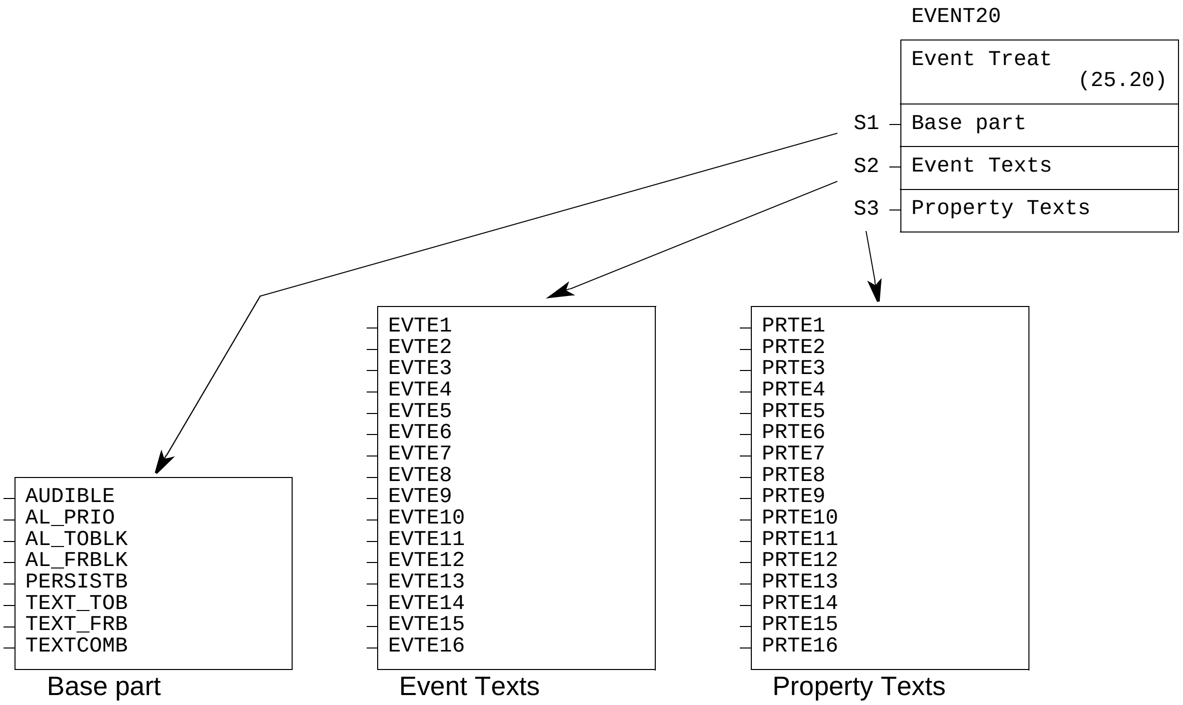


Figure 3-27. Data base element for Event Treat

3.5 Group Alarm

Different process signals and objects that are logically interrelated with regard to alarm and event handling, may be connected to a group alarm object (GRPALARM). The group alarm object and the member signals and objects then make up an alarm group.

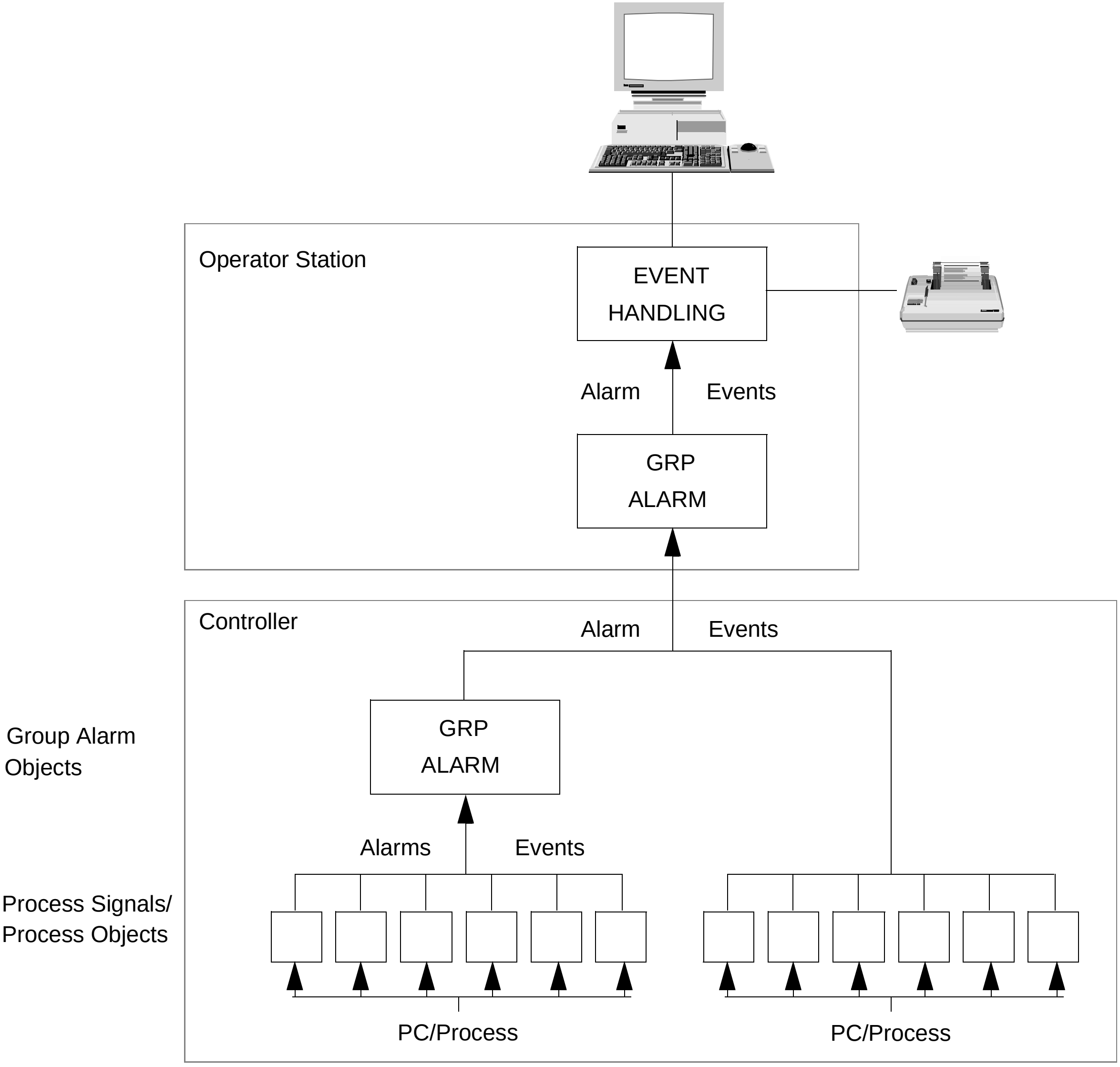


Figure 3-28. Relationship: process signals, process objects and group alarm object

The group alarm object consists of a data base element (GRPALARM) and predefined display elements and dialogs.

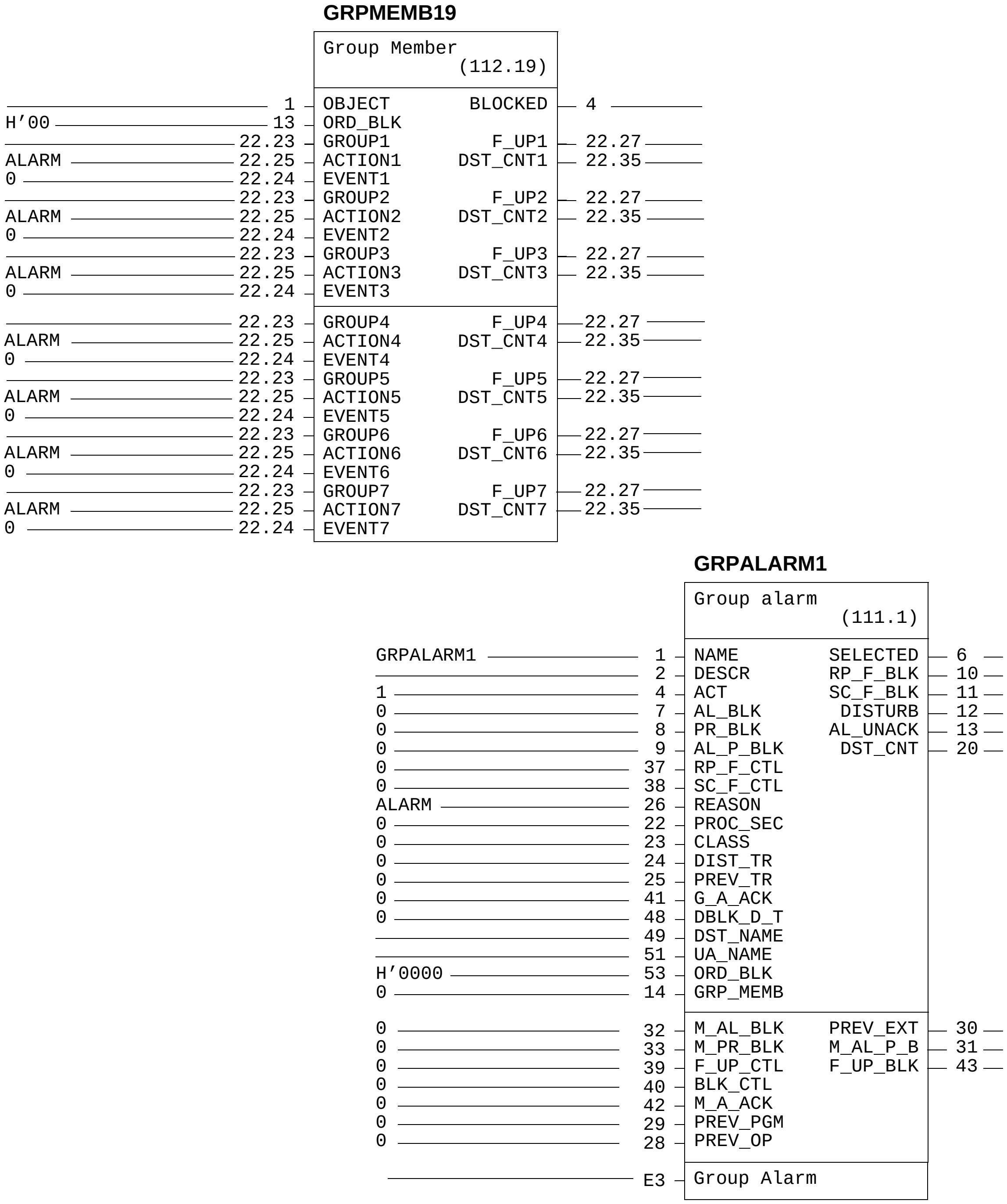
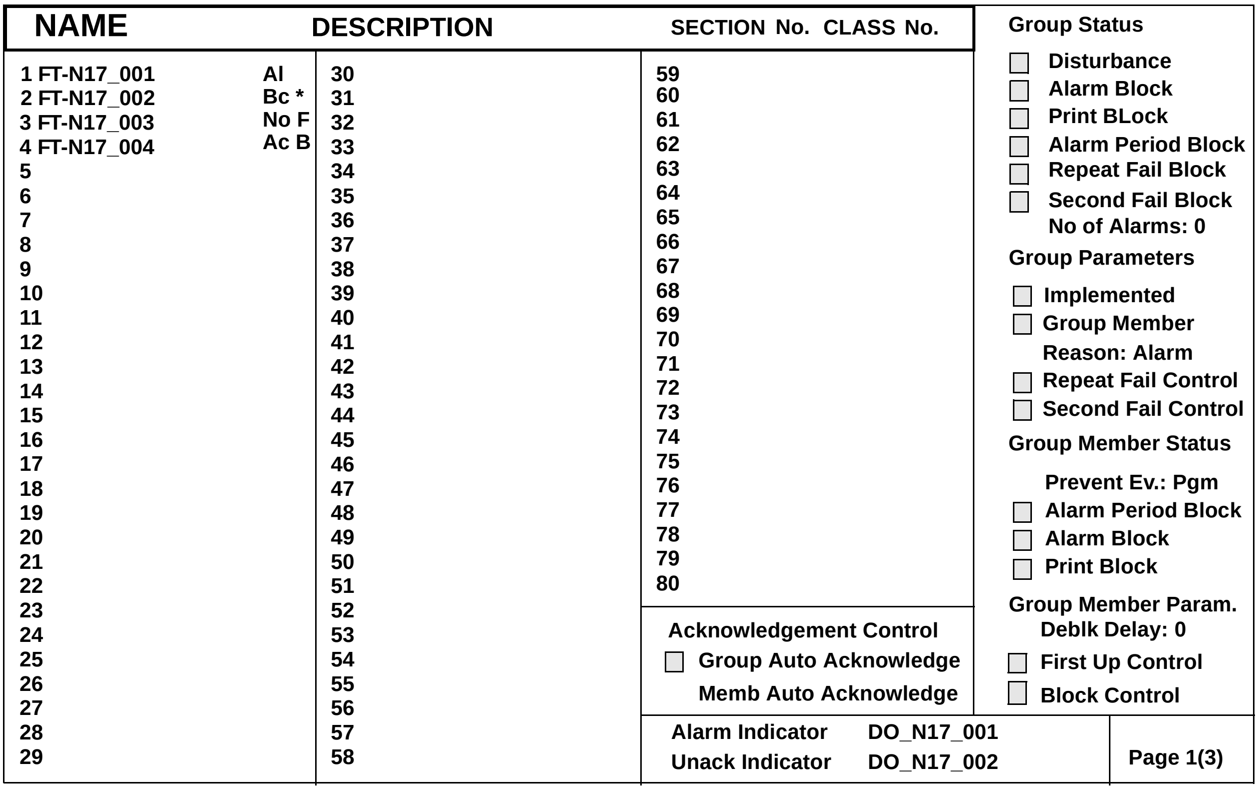


Figure 3-29. Data base elements GRPMEMB and GRPALARM

An alarm group can be configured from the object display of the group alarm object, or from the database elements of the constituent process signals and objects. A function unit, can be a member of up to seven function units GRPALARM. The database elements of a functional units, that is connected to a functional unit ALARM GROUP, have expansion segments (GRPMEMB), where up to seven (7) different group alarm function units (GRPALARM) can be defined. The extension unit is used for communication between the function unit (as a member of a group alarm) and the functional unit GROUP ALARM.



NAME **DESCRIPTION** **SECTION No. CLASS No.**

1 FT-N17_001	AI	30	59
2 FT-N17_002	Bc *	31	60
3 FT-N17_003	No F	32	61
4 FT-N17_004	Ac B	33	62
5		34	63
6		35	64
7		36	65
8		37	66
9		38	67
10		39	68
11		40	69
12		41	70
13		42	71
14		43	72
15		44	73
16		45	74
17		46	75
18		47	76
19		48	77
20		49	78
21		50	79
22		51	80
23		52	
24		53	
25		54	
26		55	
27		56	
28		57	
29		58	

Group Status
☐ Disturbance
☐ Alarm Block
☐ Print BLock
☐ Alarm Period Block
☐ Repeat Fail Block
☐ Second Fail Block
No of Alarms: 0

Group Parameters
☐ Implemented
☐ Group Member
Reason: Alarm
☐ Repeat Fail Control
☐ Second Fail Control

Group Member Status
Prevent Ev.: Pgm
☐ Alarm Period Block
☐ Alarm Block
☐ Print Block

Group Member Param.
Deblk Delay: 0
☐ First Up Control
☐ Block Control

Acknowledgement Control
☐ Group Auto Acknowledge
Memb Auto Acknowledge

Alarm Indicator DO_N17_001
Unack Indicator DO_N17_002

Page 1(3)

Figure 3-30. Object display of an alarm group

The following functional units can be incorporated into alarm groups: AI, DI, DRICONE, DRICONS, GENBIN, GENCON, GENUSD, GROUP, MANSTN, MOTCON, PIDCONA, PIDCON, RATIOSTN, SEQ, and VALVECON,

The manual, *AdvaCommand Basic Functions User's Guide*, describes the group alarm function exhaustively. In this document, the component parts are only described in a cursory manner.

The group alarm function consists of four parts as follows:

- Grouping of process alarms and events with a view to creating common alarms and events.
- Group blocking
- Auto-acknowledgement
- External alarm outputs.

3.5.1 Grouping of Process Alarms and Events

Grouping of process alarms and events means that when a process signal/object, included in the alarm group, changes status and a process alarm or event are generated. The status for the group alarm object are also changed. A process alarm or event can also be generated for the group alarm object.

By means of configuration of the alarm group or different blocking flags in the group alarm object, it is possible to suppress alarms or events both from the process signals/objects and the group alarm object itself. This means that the alarm group can be configurated so that only the relevant alarms or events are presented in the alarm or event list on the Operator Station.

The following properties of the group alarm object are relevant for the grouping of process alarms and events:

RP_F_CTL	Repeat Fail Control. Request of reduced number of reports of repetitive alarms for the group alarm object.
SC_F_CTL	Second Fail Control. When set, only the first alarm or event from the group alarm object are reported.
REASON	Defines the type of events the group is requested to manage. **ALARM**. The alarm group is affected when a signal or object, tied to the group, raises an alarm. Such a group is called "Alarm-triggered". **UNACK**. The alarm group is affected when a signal or object, tied to the group, turns unacknowledged. Such a group is called "Acknowledgement-triggered".
DIST_TR	Disturbance treatment. Pointer to a EVENT_TREAT data base element that defines the treatment of events and alarms from the group alarm object. See Section 3.4.4, Function Selection.
F_UP_CTL	Disturbance treatment. Pointer to a EVENT_TREAT data base element that defines the treatment of events and alarms from the group alarm object. See Section 3.4.4, Function Selection.

In the expansion segment, GRPMEMB, the following properties have a bearing on the grouping of process alarms and events:

GROUP	The name of the group alarm object this process signal/object is connected to. One process signal/object can be connected to seven different group alarm objects.
ACTION	Specifies the treatment of the group when those events that have been specified by the REASON connection on the GRPALARM element do occur. **ALARM**. The alarm group enters a state of alarm when this signal or object enters a state of alarm.
EVENT	Specifies those events that are to be processed by the group. When set = 0, all events are to be processed. When set > 0, all events covered by EVENT_TREAT pointers set equal to EVENT are to be processed.

3.5.2 Group Blocking

The reporting of alarms and events from member signals and objects may be blocked by order from the operator, a PC program, or by the occurrence of an event or alarm from one of the members in the alarm group.An alarm from a member in the alarm group can activate the group blocking in one of two ways:

- A member defined as blocking master affects the group blocking when it changes alarm status. All members except for those which are defined as blocking masters are blocked.
- If the First-Up function is defined for the alarm group, the first alarm or event from the group blocks the group.

The following properties of the group alarm object are relevant for blocking of the group:

REASON	See the section "Grouping of alarms and events".
PREV_TR	Prevent Treatment. Pointer to EVENT_TREAT element, defining the event handling of blocking orders. See Section 3.4.4, Function Selection.
DEBLK_D_T	Deblock Delay Time. Used for delaying the deblocking of event handling by a PC program or by a signal defined as blocking master.
M_AL_BLK	Member Alarm Block. Used by the operator to block and deblock the reporting of all events and alarms from the members.
M_PR_BLK	Member Print Block. Used by the operator to block and deblock print-out of all events and alarms from the members.
F_UP_CTL	First Up Control. When set, only the first alarm or event from a process signal/object in the alarm group will be reported in Advant Station 500 Series Operator Station.
BLK_CTL	Block Control. When set, it blocks all members, provided PREV_EXT or PREV_PGM is set. Otherwise, only alarms and events from the alarm group will be blocked.
PREV_PGM	Input for dynamic blocking and deblocking of the group members by a PC program.
PREV_EXT	Flag indicating that the reporting of events from the members has been blocked by a blocking master, or that FIRST_UP in any of the members has been activated.

In the expansion segment, GRPMEMB, the following properties have a bearing on the blocking of the group:

GROUP	The name of the group alarm object this process signal/object is connected to. One process signal/ object can be connected to seven different group alarm objects.
ACTION	Specifies the treatment of the group when those events that have been specified by the REASON connection on the GRPALARM element do occur. **BLOCK**. Defines the blocking master for the group. **NOACTION**. This signal/object will not affect the alarm group, but will be affected by a blocking master.
EVENT	Specifies those events that are to be processed by the group. When set = 0, all events are to be processed. When set > 0, all events covered by EVENT_TREAT pointers set equal to EVENT are to be processed.

3.5.3 Auto-acknowledgement

The auto-acknowledgement function works on both the group members and the group alarm object.

- An unacknowledged alarm for the group alarm object may be auto-acknowledged when all the members in the alarm group, have been acknowledged.
- Unacknowledged alarms for all the members in the alarm group can be automatically acknowledged if the group alarm object is acknowledged or if a process signal/object defined as an acknowledgement master enters a state of alarm.

The following properties of the group alarm object are relevant from the point of view of auto-acknowledgement:

REASON	See section "Grouping of alarms and events".
G_A_ACK	When set, the group alarm object is automatically acknowledged. – For alarm-triggered groups, when all the members have returned to normal. – For acknowledgement-triggered groups, when all the members have been acknowledged.
M_A_ACK	When set, all members are auto-acknowledged when the group alarm object is acknowledged.

In the expansion segment, GRPMEMB, the following properties have a bearing on auto-acknowledgement:

GROUP	The name of the group alarm object this process signal/object is connected to. One process signal/object can be connected to seven different group alarm objects.
ACTION	Specifies the treatment of the group when those events that have been specified by the REASON connection on the GRPALARM element do occur. **ACK**. Defines an acknowledgement master for the group. **NOACTION**. This signal/object will not affect the alarm group, but will be affected by an acknowledge master.
EVENT	Specifies those events that are to be processed by the group. When set = 0, all events are to be processed. When set > 0, all events covered by EVENT_TREAT pointers set equal to EVENT are to be processed.

3.5.4 External Alarm Outputs

It is possible to connect two digital outputs to each alarm group. These outputs mirror the status of the group. The one is set when the group alarm object enters a state of alarm. The other is set when the same group alarm object turns unacknowledged.

The following properties of the group alarm object are relevant for external alarm outputs:

DST_NAME	The name of the digital output to be used for alarm signal.
UA_NAME	The name of the digital output to be used for the "unacknowledged" signal.

3.6 Data Base

The data base elements in the Advant Controller 410/450 serve as an intermediate storage place for presentation, dialog, and event handling in the operators station, and the PC program in the controller. The data base elements also serve as a tool for the configuration for setting name, description, measurement range, process-related units, presentation and event-handling details, for each of the instances of a functional unit.

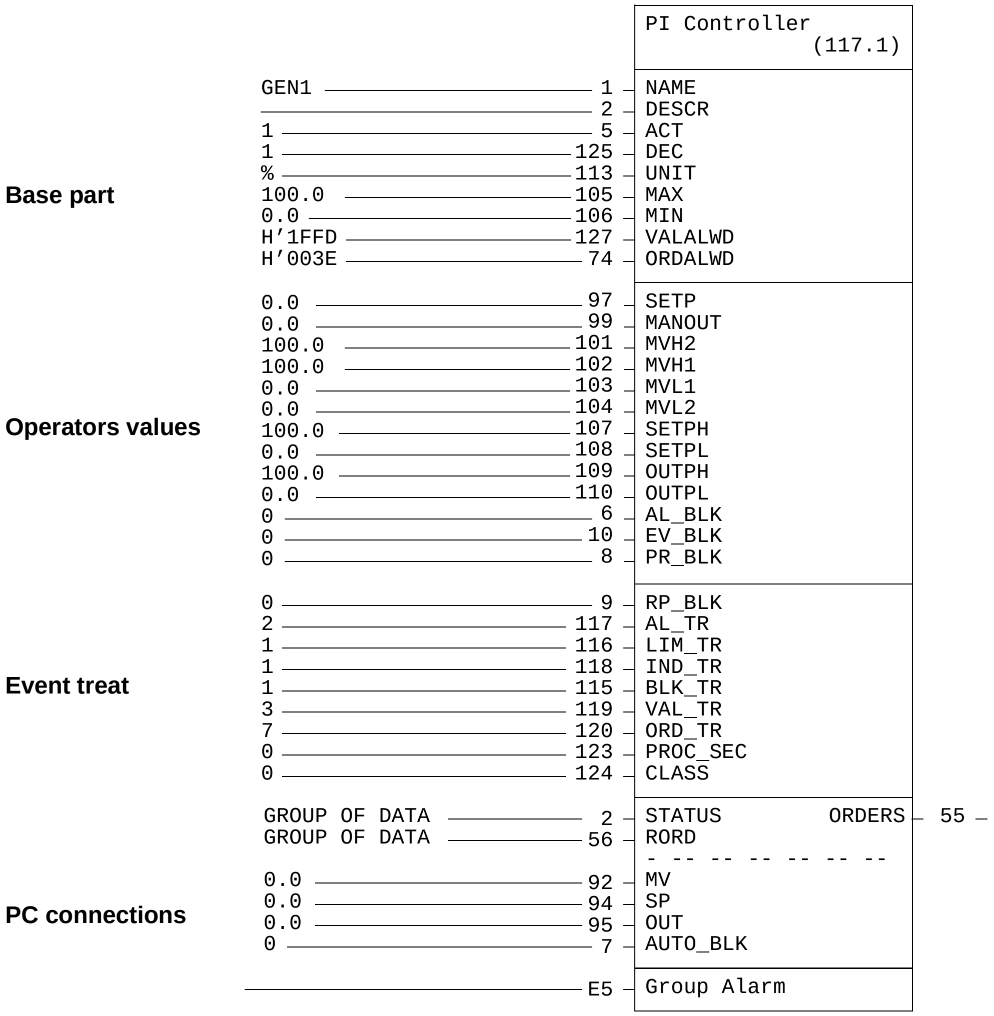


Figure 3-31. Data base element for GENCON

All connections to or from the data base element are performed in the PC program.

The different data base elements are described in the description of the functional units, but are also assembled in the manual *Data Base Elements Advant Controller 400 Series Reference Manual*. How and with which commands data base elements are created and adjusted is described in the documentation for the Advant Controller 410/450 and Advant Station 100 Series Engineering Station.

3.6.1 Different Parts of the Data Base Element

The data base element contains a set of terminals, with or without pre-defined values. The terminals in the data base element are assembled in blocks, for example base part, limit check, Operator functions and PC connections, depending on the functional unit concerned.

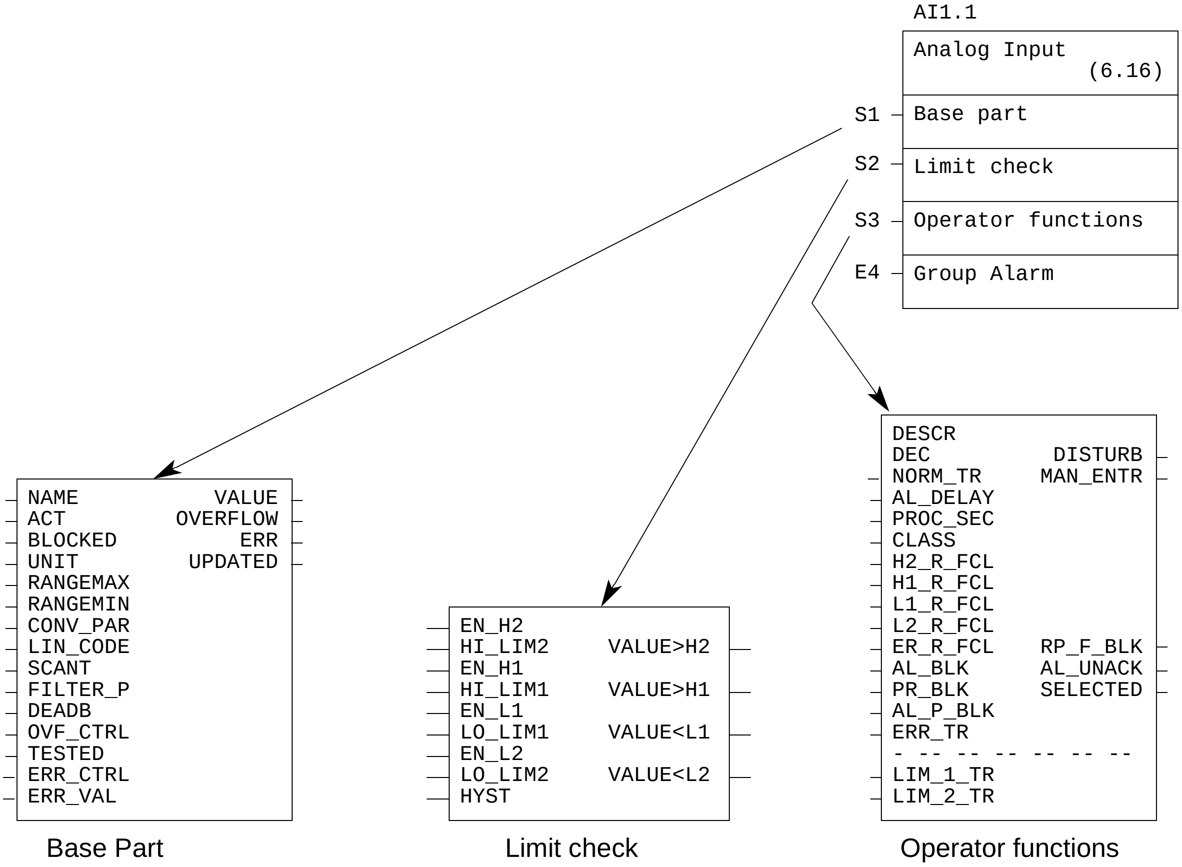


Figure 3-32. Analog Input data base element

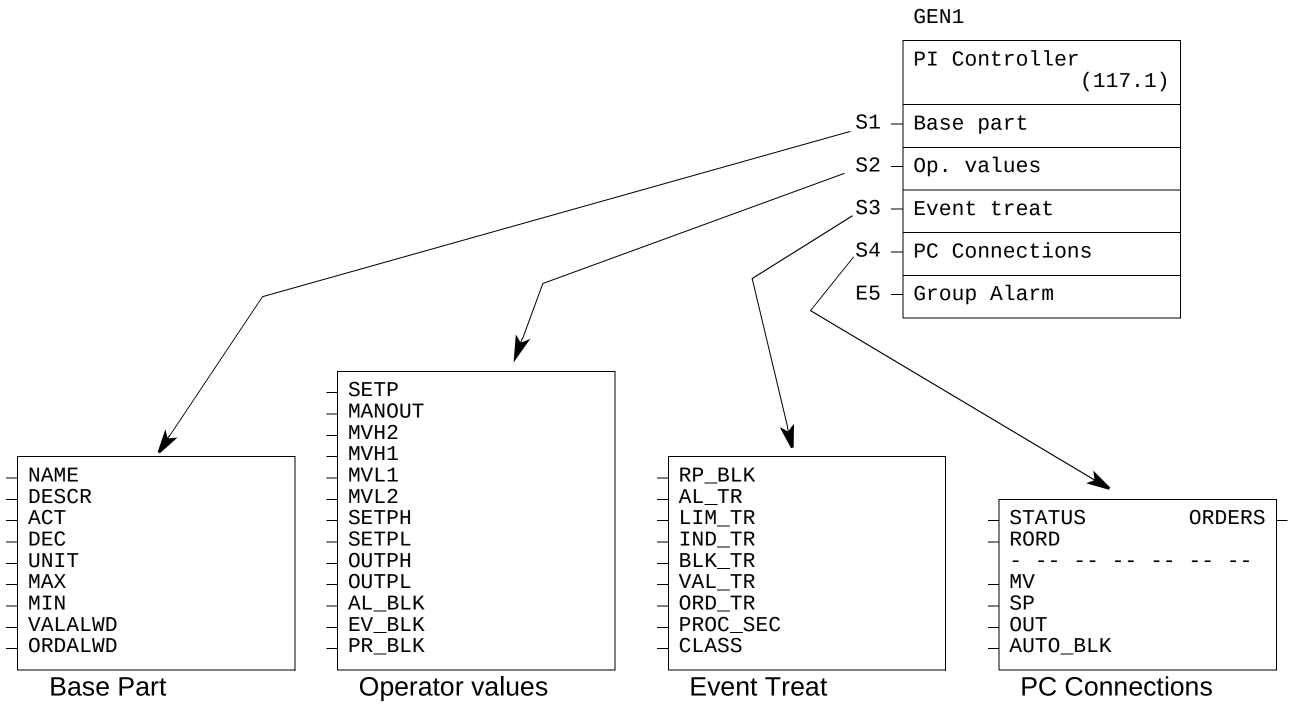


Figure 3-33. GENCON's data base element

3.7 PC Element

Control functions or distribution and collection of signals are performed in the PC element of a functional unit.

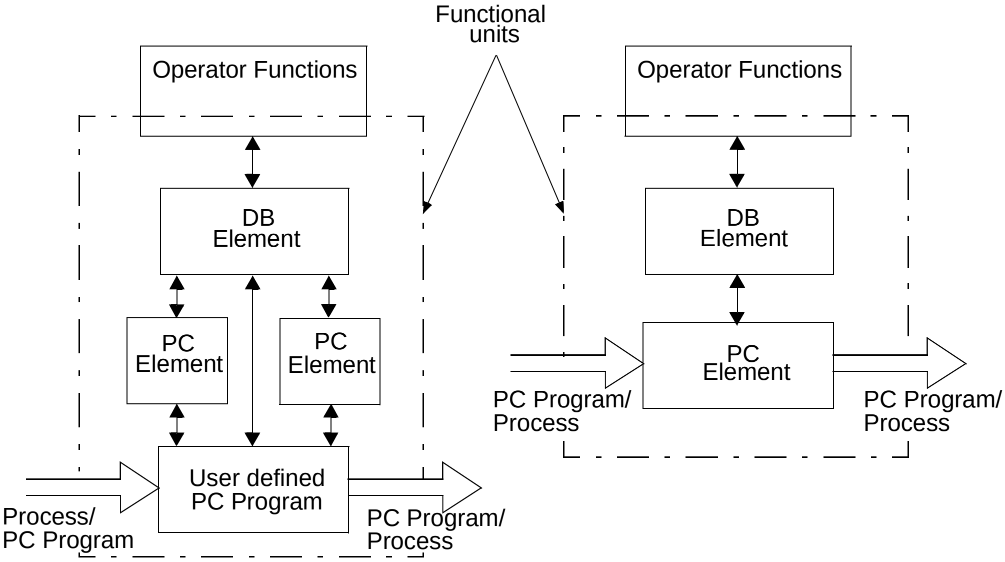


Figure 3-34. Functional units GENCON and PIDCON as symbols

The PC element of a functional unit is a part of a PC program and is handled in the same way as all other PC elements in the function library.

3.7.1 Principles of Connection to Data Base Elements

The PC function in a functional unit is normally to be connected to an associated data base. This is done in a standardized, but somewhat varying manner, depending on the principle of the design of the functional unit.

The design principle has been used in earlier sections to define three different groups 1, 2 and 3, and the description below is based on this division.

General

The properties in the data base (terminals on the data base element) which can be connected to from a PC program are discussed generally in Section 3.6, Data Base.

Instead of the name reference utilized in the following figures, which give examples of the coupling PC data base, the item designation **"File.Record:Terminal"** can be used. The item designation is shown by the data base element.

Group 1

These functional units have no "own" PC function, but connection to a PC program is a common practice. This is performed through data base connections, during the PC programming. Figure 3-35 gives examples of such connections. The following should be noted:

- When connecting to a signal value (VALUE) the data base element terminal need not be specified. The circuit/unit identity is sufficient.
- On connection to AI Calculated and DI Calculated, the PC program is to write in the connection: CALCVAL. VALUE must only be read.

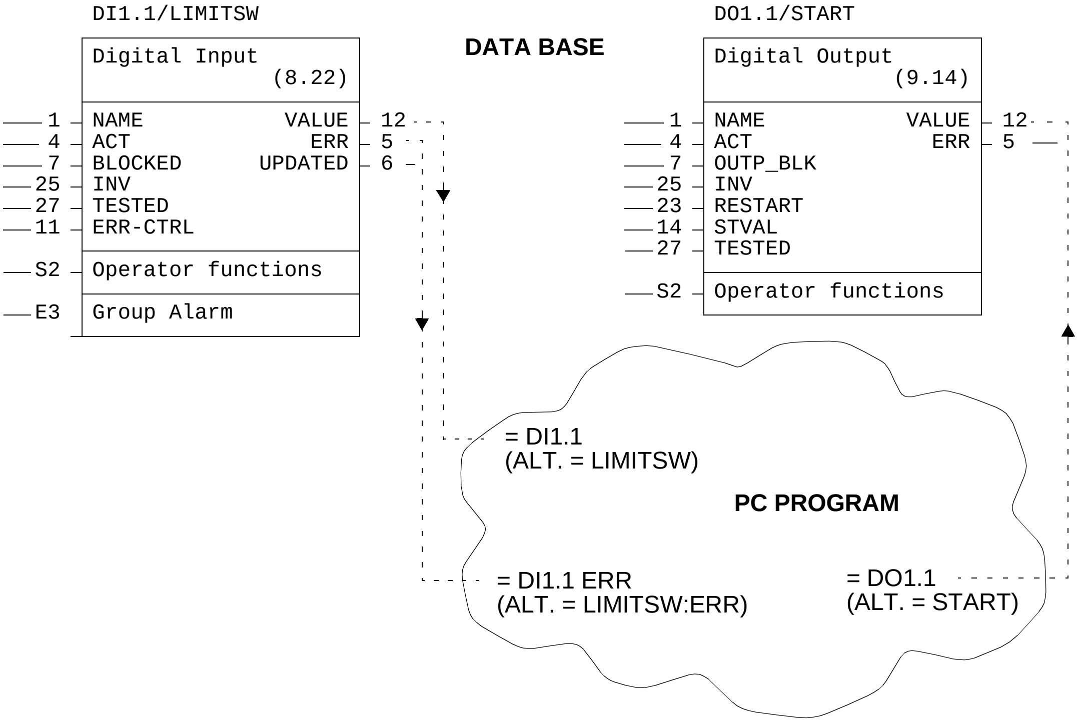


Figure 3-35. Examples of connections between PC program and DI, DO

Group 2

Functional units in this group have PC elements for collection of logical signals for display presentation, alarm and event handling. There are also PC elements for logical order signals from the operator. Such an interfacing element is connected to the data base with a combined package of several signals, in the example, STATUS and ORDERS respectively. All real values are connected individually and directly between the application-adapted PC program and the data base element.

A terminal DBINST (Data Base INSTance) is utilized to link the PC program with the event handling in the Operator Station. The data base instance name (GEN1 for example) or the data base instance number specified as a constant (D=12 for example) is specified here. Figure 3-36 shows the principles of the connections.

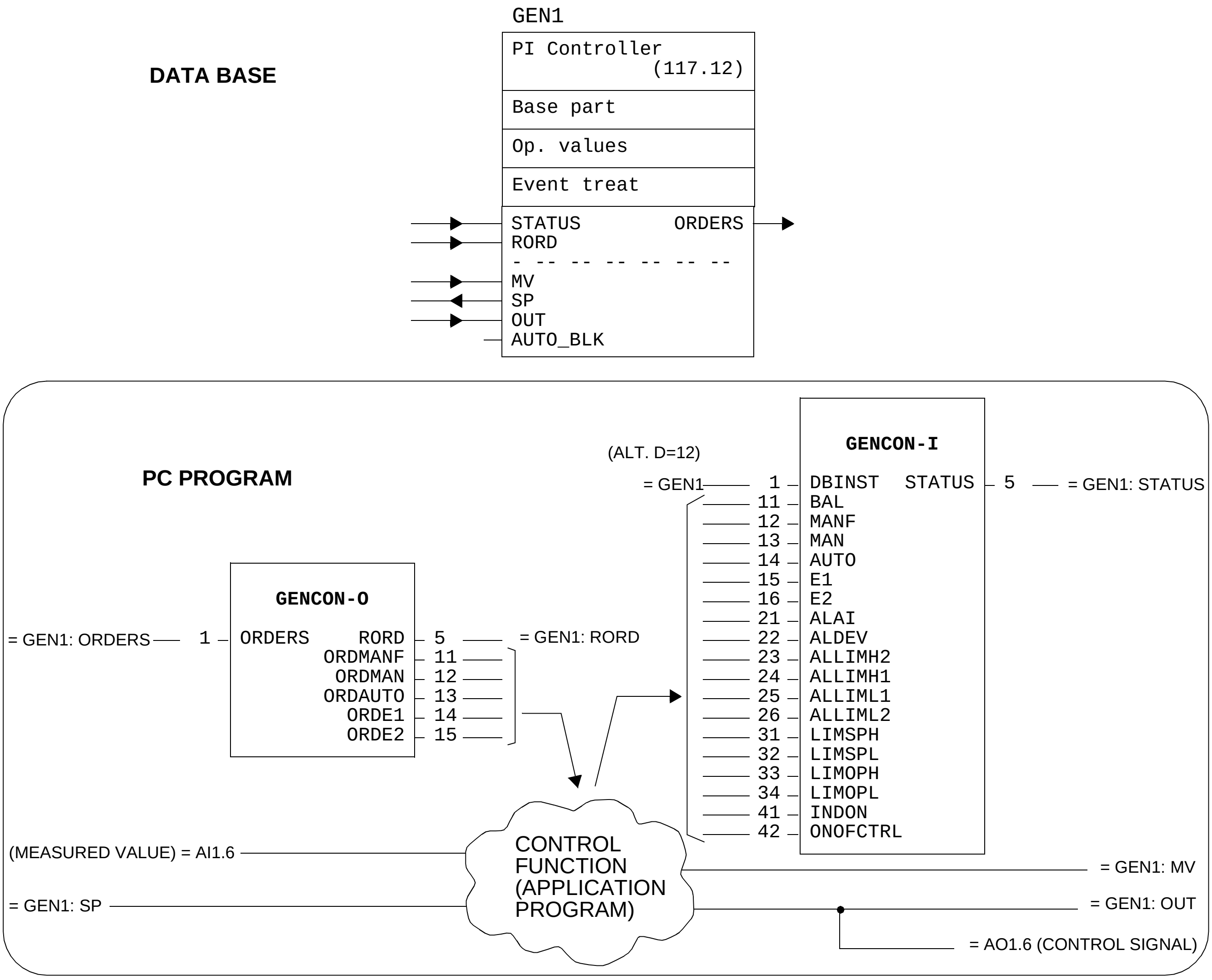


Figure 3-36. Examples of connections between PC program and GENCON

Group 3

There is a functionally serviceable PC element for a functional unit belonging in this group. This PC element is connected to the data base element. For PIDCONA, PIDCON, RATIOSTN and MANSTN the reference DBINST is also specified. (compare group 2). For PIDCONA this is the only visible connection. All other functional units in the group have a number of special connections which are packages of signals containing both orders, statuses, and values of type real.

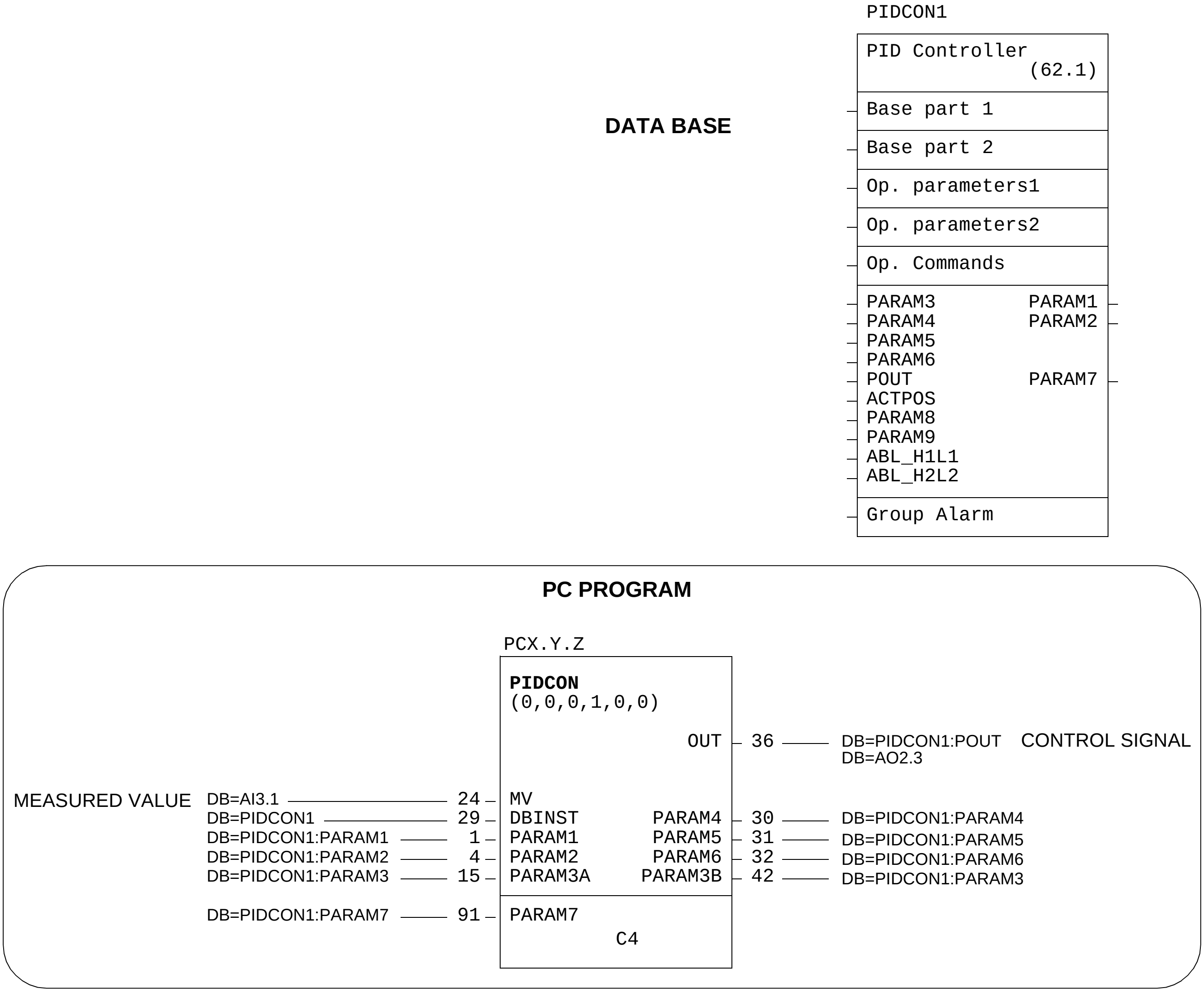


Figure 3-37. Examples of connections between PC programs and PIDCON

3.8 Stop and Startup Functions

3.8.1 General

Program functions are stopped and started in different ways, in accordance with the circumstances. After a stop, it may be necessary to store important information before the following restart. In some circumstances it may be appropriate to restart the program code for a function from start position. On other occasions, after a very brief interruption, a restart can perhaps be made from the point at which program execution had ceased without further action. Longer interrupt times can require restart with changed parameters. For example, a PID controller can be forced to manual control mode with a frozen output signal.

Start can be automatic, for example after a voltage failure. In Advant Controller 410/450 systems, it is possible, by means of the application program, to select the restart function appropriate to the length of the interruption. Manual start can be performed by means of a push button on the front of the CPU module or from an Advant Station 100 Series Engineering Station. Start is also commanded indirectly via the Engineering Station with concluding commands in connection with reconstruction or reprogramming.

A restart can apply to a complete system (Advant Controller 410/450) or a certain part, for example, one or more individual PC programs.

In this section, the behavior of the functional units in connection with different forms of stop and startup is discussed. First a few words in relation to the status adopted in connection with a stop.

3.8.2 Stop Functions

Stop or "system halt" is obtained with different types of central faults in CPU, memory and power supply. Mains power failure also causes stop. There is also the possibility of commanding STOP using a selector and a push button on the front of the CPU module.

These stoppages imply that the database is left intact. However, the process outputs take on a predefined, safe state, which for Advant Controller 410/450 means zero, that is logical zero, open contact, 0 V for analog voltage signals and 0 mA for analog current signals.

Other commands which result in the stop of a complete process station are CLEAR (cold start of the system) and the configuration command RECONFIG (redimensioning/reconfiguration). The serious consequences of such a stop are described in Section 3.8.3, Start Functions.

ECONFIG (configuration status) gives a "non destructive" stop. No application program is affected but all program execution is stopped. In an application, it is important that the status of the process outputs are well defined in connection with the stop. All the events and commands named lead to a defined safe status which, for Advant Controller 410/450, is zero output signal, irrespective of the inversion requirement and sign-changing scaling in data base elements. Each output board has a built-in function for securing this status.

Where the signal is received from an Advant Station 410/450, which is stopped, the value or status is frozen in a display presented at the Advant Station 500 Series Operator Station. In other words, there is no updating. If the display is requested after the stop, a blank field is obtained at the place at which the value or status should have been presented.

The system halt of an Advant Controller 410/450 is indicated with a system alarm in Advant Station 500 Series Operator Station and with a character display and LED's on the Advant Controller 410/450 concerned.

When programming an individual PC program under the command EBM (Enable Build Mode) a somewhat different "stop function" is obtained. The process outputs connected to some element in the specific PC program which is affected will be force-controlled through the command EBM. Program functions execute a resetting to zero of the data base and the data base elements concerned, (the PC elements are reset executed and the data base is updated).
The values or status of the physical output then are determined by the PDC software (the process data communication) which, as distinct from the case of the command ECONFIG, continues to execute under command EBM. The real status of the outputs is thus determined by whether, in the data base element, inversion has been requested or, in the case of an analog output, special scaling. In displays in Advant Station 500 Series Operator Station the status zero or the value zero will be updated under the command EBM.

Partial stop within a Advant Controller 410/450 can be achieved with other commands from the aid. For example BL (BLock) can stop execution of one or more execution units (CONTRM). BL DB (BLock Data Base) stops writing of data from a program to the data base. In both cases the values of the data base and the physical output signals are frozen.

BLRS (BLock ReSet) resets first the outputs of the PC element and the data base values connected to the program concerned before the updating and program execution is stopped. Note that possible inversion or scaling in the data base element affects the value of the physical output.

BLRS DB (BLock ReSet Data Base) means that only the data base values connected to the PC program concerned are reset to zero.

BL DB and BLRS DB apply only to explicit connections from the PC program to the data base, and not to the transfer of values from the PIDCONA PC element to its data base element, which is done without visible connections.

3.8.3 Start Functions

The different ways of starting Advant Controller 410/450 are described in general above. Different start functions are to be defined here and the ways to initiate these will be described. Table 3-2 illustrates the connection between commands and functions. The function after return of power is also included in the table.

Table 3-2. Relation between command and start function obtained

Command	**Function**		
	Cold start system	**Warm start system**	**Restart system**
Manual Startup			
CLEAR MODE	X		
AUTO MODE		X	
Config. Commands			
RECONFIG	X		
DICONFIG		X	
Power Up	x (1)	x (1)	x (1)

(1) Depending on the parameter values of the function programmed start up

Cold Start

A cold start of a Advant Controller 410/450 means that the data base and PC program are cleared. An application program must be built-up from the beginning with dimensioning of the data base and the build-up of the PC program. If the program has been previously dumped to the Advant Station 100 Series Engineering Station, this can naturally be reloaded.

Warm Start

A warm start of a Advant Controller 410/450 means that data base functions and PC program are executed in an Init mode where all dynamic information is initialized, most of it by resetting it to zero. There are system functions which organize the start sequence of the different program parts. Of particular interest for the application programmer is that after the initialization, there is first a collection of current process values and status. Different PC program are then started in a sequence pre-determined by the programmer. Finally, new values and command signals are issued at the physical outputs of the system and on communication channels to other computers.

The initialization of dynamic information before the start is of no significance in most applications. But if the application program contains functions to accumulate values, for example with quantity measurement or measurement of expired time, special program function should be created to secure the value during a stop and before a start.

Some general consequences of a warm start for the functional units are taken up in the following points. Further details of the different units follow. Note that PIDCONA, PIDCON, RATIOSTN and MANSTN have certain possibilities of application-adapted warm start functions.

The application program code is not affected by a warm start.

The data base function of the functional unit notifies the Advant Station 500 Series Operator Station of the startup and the alarm list is cleared of “old” persisting alarms. The list is then adapted again with alarms which have been evaluated after the restart. New time tags and new acknowledgement requirements are obtained thus. The application programs for PIDCONA, PIDCON, RATIOSTN and MANSTN must be adjusted to a degree to obtain this function. See further Section 3.8, Stop and Startup Functions.

The signal value VALUE in the data base of a functional unit is reset to zero in the Init mode. Parameter values of RANGE MAX, UNIT and so on are not affected provided that the PC program is not connected to the parameter. Resetting can then be performed via the Init mode of the PC program (see below).

An exception from the rule that VALUE is reset to zero applies to the data base element DAT. This is of particular importance in the case of the application program. DAT VALUE is not affected by the initializing function of the data base.

When a PC program is executed in the init mode, the data base is not reset by the PC element. The dynamic information will however be reset internally in the PC. This will affect the data base in the succeeding normal execution of the PC program.

Terminals in the data base which are connected to outputs on a PC element will be reset. Calculated values stored in the data base element DAT can remain unaffected after a warm start by designing the PC program for reading back the data base value during the first normal execution of the PC program. Figure 3-38 shows an example of this function. Dynamic information can also be stored during the stop and start procedure with a special PC element, REG-RET.

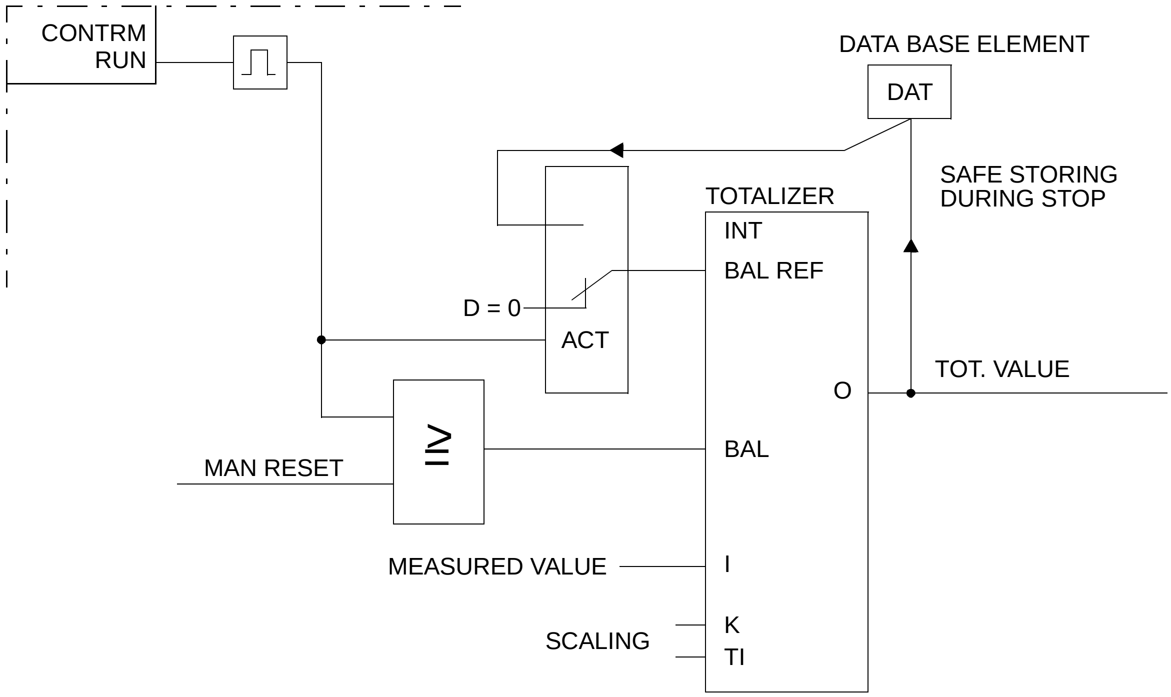


Figure 3-38. Securing of an accumulated value during a stop-start procedure (Does not apply to EBM PCx or DIBM PCx)

Restart

A Restart is similar to a warm start. However, at restart the PC element will not be executed in an Init mode and the data base elements connected to PC element outputs will not be reset. This means that counters, integrators, sequences, and so on will keep their values from where they left off at the time of the previous stop.

3.8.4 Special Notes for Functional Units

General

For practical reasons, certain functional units can be stopped and started individually. This applies to AI, AO, DI and DO which work together with process I/O and their calculated variants, AIC and so on. In this connection, it is also of interest to know that complete circuit board functions can be disconnected for, for example, replacement of a faulty board. In Advant Controller 410/450 installations the disconnection is an automatic result of the extraction of an I/O board from its place in the rack. The old value/ status is frozen in the data base while the board is absent from its place. Alternatively, the value/status in the database may be assigned a predefined value. The error flag is set to 1. When a new board is set in place, there is also an automatic initialization and restart within 10 seconds.

Alternatively, the board may be shut down and started up manually, either from a Advant Station 500 Series Operator Station, by means of the command DEACT and ACT respectively, or from an Advant Station 100 Series Engineering Station. This is done by resetting the SERVICE flag to 0, in the board data base element. The board function is restarted by setting SERVICE to 1.

Another way to disconnect a complete board function is provided by the terminal IMPLemented on the data base element of the board. If IMPLemented is set to 0 the board function is blocked. This deactivation results in resetting to 0 of the value/status in the data base of all channels which belong to the board.

Setting of IMPLemented to 1 restarts the board function.

The corresponding blocking of an individual I/O channel (individual functional unit AI, AO, DI, DO) can be performed by resetting to zero the connection ACTive on the data base element.

The value/status of the instance is reset to zero. A start is obtained by setting ACTive to 1.

AI, Pt 100, Thermocouple, AI Calculated

With a warm start, there is always a preliminary resetting of value and status flags for, for example, limits exceeded. A current value is then measured and a new comparison is made with the limit set. Any passage of a limit is reported as a new event or a new alarm.

DI, DI Calculated

With a warm start, there is first a resetting to zero of the value VALUE which represents a logical status which has been measured or calculated. A current value/status is then acquired from the process (or PC program for the variant DIC) and a comparison is made with the status which at configuration was defined as the normal status. If any difference is detected and if the system has been configured for event handling, a new event or alarm is reported to, for example, an Advant Station 500 Series Operator Station.

AO, AO Calculated

The functional units AO, AOC contain a special startup function. This can be used to force-control the output in different ways with a warm start. Outputs are always reset to zero during a stoppage. After a start, an individual output can either retain its latest value (that which it had immediately before the stop) or it can adopt a predetermined value. The version, and in the latter case, the value, can be selected individually in the data base element for each functional unit utilized.

The use of the startup function is limited however. The time between the points in time at which the startup function force-controls the output and when the PC program updates the outputs with the current value from the calculation performed is normally very short (a few seconds).
The advantages of forcing the output to the required value some seconds earlier than it would be controlled to this value by the PC program are insignificant. The startup function can however be valuable in applications with sequences. In such cases, the value of an output can be calculated in an earlier sequence stage and the function "latest value" can be relevant at restart after a brief interruption.

DO, DO Calculated

The functional units DO, DOC have a startup function corresponding to that of AO, AOC.

SEQ

The PC element section of the sequence executes the special routine designated RESET PC element with all forms of start. This results in the resetting to zero of all dynamic information, the resetting of all steps and the adoption by all individual signals in the step logic of their zero positions. Execution of the sequence begins from the beginning. Any alternative function must be obtained with a special application program with storage of important information and a suitable startup sequence.

GENXXX

In the same way as for the sequence, a start always means a resetting of the dynamic information through the RESET PC element. A consequence of this is that the connections to the GENXXX-1 element for the functional unit which were set to 1 at stop and which are reset to 1 as soon as execution of the program is restarted, will give new events and alarms to the Advant Station 500 Series Operator Station. The programmer writing the application program must also take into consideration such questions as which control mode the controller is to adopt at start.

PIDCONA, PIDCON, RATIOSTN, MANSTN

General

For functional reasons, PIDCONA, PIDCON, RATIOSTN and MANSTN have a more flexible warm start function than other functional units. For examples it is possible to choose between alternative startup functions with a function parameter "HOT INIT".

It is thus possible to adapt the start to the demands of the application, for example by selecting the control mode with which the controller is to start and the output signal it is to have.

- Warm start of PIDCONA, PIDCON, RATIOSTN and MANSTN with the function defined with HOT INIT parameters is obtained:
  - With AUTO, for example after a mains supply failure
- Start of PIDCONA, PIDCON, RATIOSTN and MANSTN with the function Reset PC element is obtained:
  - After DIBM (DIsable Build Mode).
  - After BLRS (BLock ReSet).

Note that PIDCONA, PIDCON, RATIOSTN and MANSTN has a Reset PC element function which for functional reasons does not generally include resetting to zero of dynamic information. This is shown by the tabulation for the different functional unit types below.

PIDCONA

Warm start can be performed in one of three different ways, selectable with the HOT INIT parameter.

Parameter value	Function
0	No change from the conditions which applied before the stop.
1	Manual control mode, frozen output signal. Otherwise no change.
2	Manual control mode and the value of the output signal becomes the minimum value, provided that the minimum value is 0. The output signal is otherwise set to 0. No change otherwise.

If auto tuning was going on, it is stopped, independent of the value of HOT INIT. If there are any persisting alarms, they will be reported again to the Operator Station, unless they have become blocked.

- Reset PC element resets all PC element outputs to zero (0) except CURRZONE which becomes one (1)). No control mode is indicated, and the values in the data base intended for display in the operator station are reset.The values that are normally supplied by the operator or the auto tuning (such as units, alarm blocking, saved parameters and the AUTO setpoint) are left unchanged, except the manual output value which is reset. If auto tuning was going on, it is stopped.

  When normal execution is resumed, the control mode is MAN, and the output value is zero (0) but restricted to be within high and low limits. Controller parameters are restored by copying the saved ones. The choice of tracking and bumpless is taken into account directly. Any persisting alarms will be reported again to the operator station, unless blocked.

PIDCON

Warm start can be performed in one of three different ways, selectable with the function parameter HOT INIT.

Parameter value	Function
0	No change from the conditions which applied before the stop.
1	Manual control mode, frozen output signal. Otherwise no change.
2	Manual control mode and the value of the output signal is set to zero (0) and then restricted to be within high and low limits. No change otherwise.

If the alarm function is utilized, it must be ensured, at start, that persisting alarms are again reported to Advant Station 500 Series Operator Station. This is performed with a circuit in accordance with Figure 3-39. The circuit can be used in common by several functional units, PIDCON, RATIOSTN and MANSTN within the same control module.

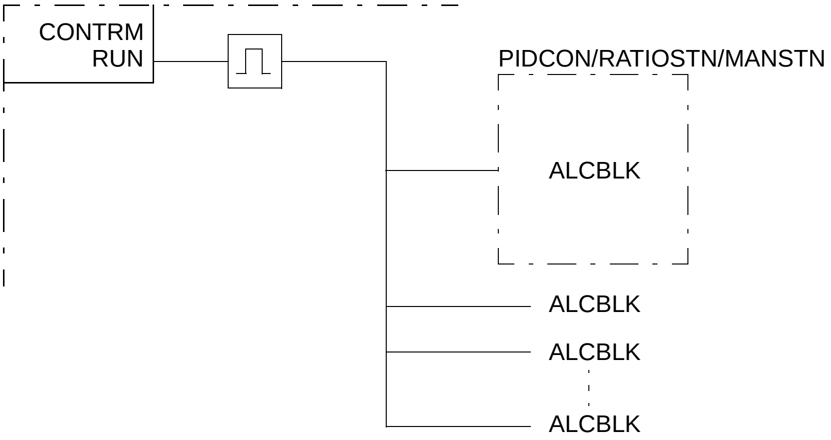


Figure 3-39. PIDCON, RATIOSTN and MANSTN, reporting of persisting alarm with a warm start

Reset PC element means that the output signal and the setpoint are set to zero (0) and then restricted to be within high and low limits. If the tracking function is used, the setpoint will have a value in agreement with the function selected. Other values such as limits and parameters are not affected by the Reset function. The control mode becomes MAN unless MAN FD (forced) applied at the stop (in which case MAN FD remains active). Other conditions such as alarm blocking and blocking of the integrator and derivative parts of the controller remain blocked. After Reset, an alarm will be generated provided that there is an alarm status and that the alarm is not blocked.

This means that an alarm which had been reported before the Reset PC element will again be reported as an alarm.

RATIOSTN

Warm start is performed in three different ways, selectable with the function parameter HOT INIT.

Parameter value	Function
0	No change from the conditions which applied before the stop.
1	Manual control mode, frozen output signal. Otherwise no change.
2	Manual control mode and the value of the output signal are set to zero (0) and then restricted to be within high and low limits. No change otherwise.

The alarm function is handled in the same way as described for PIDCON.

- Reset PC element means that output signal and ratio are set to zero (0) and then restricted to be within high and low limits The value is otherwise set to 0.
- Other values such as limits and bias are not affected by the Reset function. The control mode becomes MAN. Other conditions such as blocking of alarms remain active.
  With respect to the alarm functions, the same applies as with PIDCON.

MANSTN

Warm start is performed in two different ways, selectable with the function parameter HOT INIT.

Parameter value	Function
0	No change from the conditions which applied before the stop.
1	Manual control mode, frozen output signal. No change otherwise.

The alarm function is handled in the same way as described for PIDCON.

Reset PC element means that the output signal is set to zero (0) and then restricted to be within high and low limits. Other values such as limits are not affected by the Reset function.
The control mode becomes MAN. Other conditions such as alarm blocking remain in effect.
The alarm functions are the same as those for PIDCON.

MOTCON

The principle is here the same as for the other functional units that is all dynamic information is reset to zero. The start results in the control mode becoming SEQ (sequence) but the motor is not restarted automatically even if it was in operation when the stop was commanded. If such a restart is required, an application program must be introduced. An application program can also be used to force the control mode to other than SEQ at start. Persisting alarms are again reported to Advant Station 500 Series Operator Station at start.

VALVECON

All dynamic information is reset to zero at startup. The control mode becomes SEQ (sequence) and the valve is controlled automatically to its normal status, irrespective of its position when the stop was commanded. The normal status is defined with the parameter FINV on the PC element. Any alternative status required is to be provided with a special application program. As for MOTCON, an application program can also be used to force the control mode to other than SEQ at start. Persisting alarms are again reported to the Advant Station 500 Series Operator Station at restart.

3.9 Alarm and Event Blocking

Information regarding alarms and events is normally of great importance to the process operator. However in some types of operations and with faulty transducers, certain alarms and events are not relevant. To reduce the operators workload by eliminating the presentation of unnecessary information and by reducing the alarm-acknowledgement requirement, the control functions should be designed with automatic alarm-blocking in predetermined circumstances. For example, a stop command to a pump, should also block alarm signals for low pressure. The operator should also be able to block the presentation of unnecessary alarms when tuning a function or when a transducer is faulty.

The functional units have been provided with various possibilities of blocking alarm and event presentation both via a dialog from a keyboard/display screen and through special inputs on data base elements or PC elements.

The following describes the design philosophy on which the standard blocking possibilities are based.

1. Operators blocking (Performed by an authorized operator)
   - Blocking of presentation only
   - The blocking is always presented in the Advant Station 500 Series Operator Station displays.
2. Automatic blocking (Performed by the control program)
   - Blocks the presentation and for certain functional units, also the control function.
     a. The blocking is not presented in the displays.
     b. The blocking is presented in the displays.

The group alarm function makes it possible to block the alarm and event handling for all the members of an alarm group. The group alarm function is described in Section 3.5, Group Alarm.

Alarm and event presentation is blocked so that acknowledged alarms are deleted from the alarm list and new alarms and events to the alarm and event lists respectively are blocked. An unacknowledged alarm is only deleted after acknowledgement. Indication of a blocking is obtained in accordance with the blocking type as explained above. An indication can be, for example, a yellow B adjacent to the alarm limit (object display) or the color of the name of the object blocked (functional unit) changing to yellow.

The functional units have, in addition, depending on their type, a varying number of blocking functions intended primarily for functional selection in connection with the configuration. This could be, for example, selection of the status which is to activate an alarm and event (EVENT BLOCK). Whether or not repeated changes of status before acknowledgement are to give a new alarm or not can also be selected (REPEAT FAIL BLOCK), and so on. Information about such configuration parameters is given in the individual functional unit descriptions.

A comparison of the resources of the standard functional units with respect to the two types defined is given in the following:

1. Operators blocking.
2. Automatic blocking of alarms and events.

3.9.1 AI, DI and their Calculated Variants

With reference to previous definitions of blockings, the following standard functions can be utilized:

☒	☐	☒
1	2a	2b

Comments:

- Control signal for automatic blocking is coupled to the AL_P_BLK (ALARM PERIOD BLOCK) connection of the data base element. If this connection is set to 1, all alarm and event handling in the Advant Station 500 Series Operator Station for the object concerned is blocked. Printouts on the printer are also blocked.
- To block status indication used for a control function such as high level H2, it is necessary, for AI (and DI), to introduce an extra PC element in accordance with the principle illustrated in Figure 3-37. In this case, the status indications are not affected by AL_P_BLK.

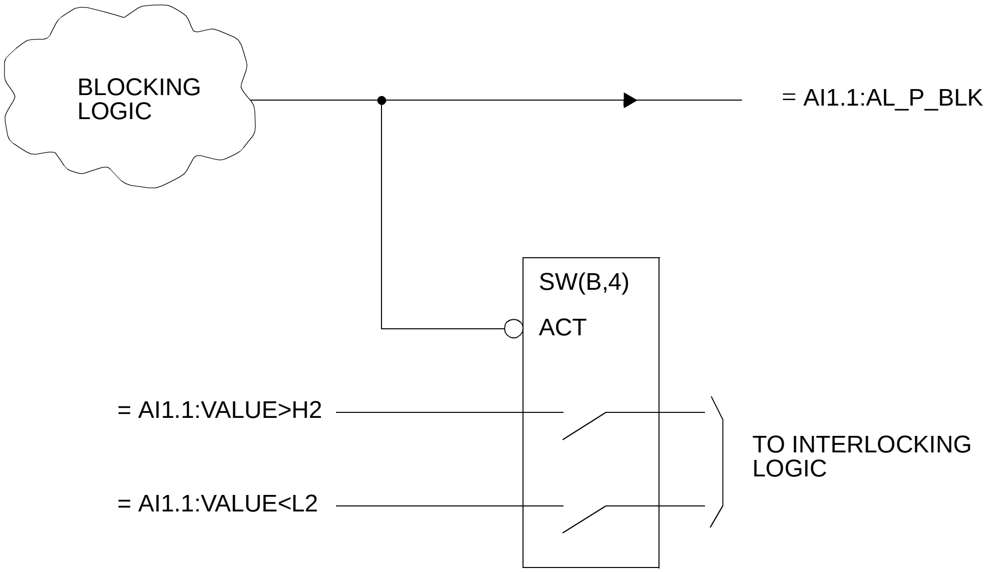


Figure 3-40. AI, automatic blocking of both presentation and control function

3.9.2 PIDCONA, PIDCON, RATIOSTN, MANSTN

Standard functions:

X	X	X
1	2a	2b

Comments:

- Automatic blocking which is not indicated by changes in the displays (2a) is obtained by coupling the control signal for alarm blocking to the ALCBLK (ALARM CONTROL BLOCK) connection on the PC element. If this connection is set to 1, alarm and event handling in Advant Station 500 Series Operator Station for the object concerned is blocked. The blocking applies to all alarm limits. Printout on the printer is also blocked. Note also that the status indications in the PC program for example MV < L1 are also blocked in this case.
- If an identical function is required with indications in the displays that a blocking is active (2b) the control signal is coupled, in addition to ALCBLK, also to the data base element connections ABL_H1 L1 and ABL_H2 L2 via a time delay (T > PC program sampling time). See Figure 3-41.
- If one only wants alarm blocking, including indication of this on displays (2b), without the status indication in the PC program being affected, for example MV<L1, the control signal should be connected to ABL_H1L1 and/or ABL_H2L2.

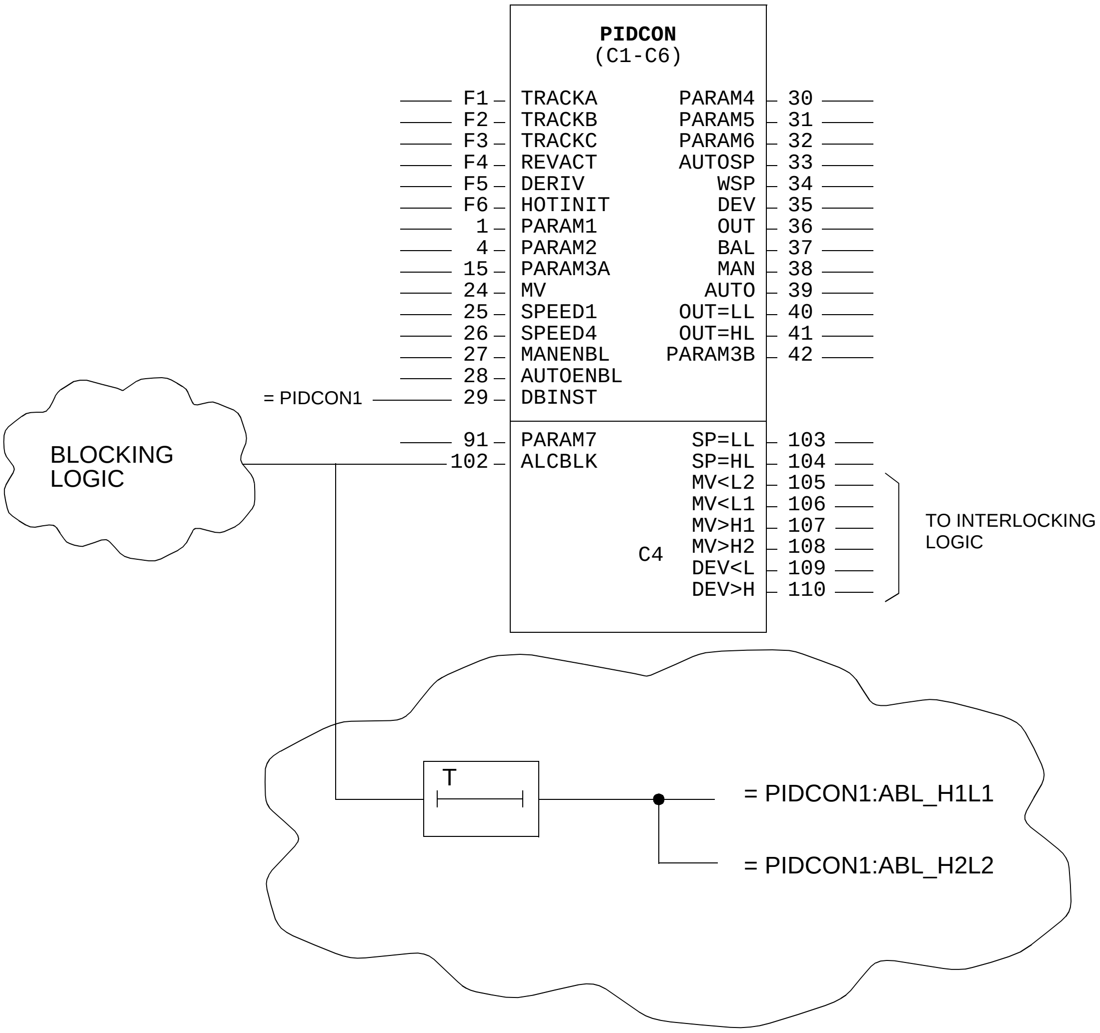


Figure 3-41. PIDCON, automatic blocking of both presentation and control functions.

3.9.3 GENXXX

Standard functions:

X	X	X
1	2a	2b

Comments:

- Automatic blocking without indication in the displays (2a) is obtained by entering, in the application program for the user-defined functional unit, a blocking between, for example, the level detection and GENXXX-I which conveys alarm status to the Advant Station 500 Series Operator Station.

  An SW-element has been used as an example in Figure 3-42. If the ACT-input is set to 1, alarm and event handling in Advant Station 500 Series Operator Station for the object concerned is blocked. The blocking applies to the status of all of the alarms in the example. Printout on the printer is also blocked. Note that the status indications which are utilized further in the PC program are also blocked.

- If a function, identical, but with indication in the displays that a blocking has been introduced (2b) is required, the control signal is connected in addition to the created blocking input in the PC program (for example SW-element, ACT-input), also to the AUTO_BLK connection on the DB element via a time delay (T > PC program sampling time). See Figure 3-42.

- If one only wants alarm blocking, including indication of this on displays (2b), without the status indication in the PC program being affected, the control signal should be connected to AUTO_BLK only.

- For functional units in the GEN-family with its more flexible construction, there are more possibilities than for other functional units to adapt the blocking functions to special application requirements. For example, individual blocking of a particular alarm status for an object is possible, other alarm status remaining unblocked. It is also possible for the automatic function to block the presentation but not the status indications which may be required for interlocking purposes.

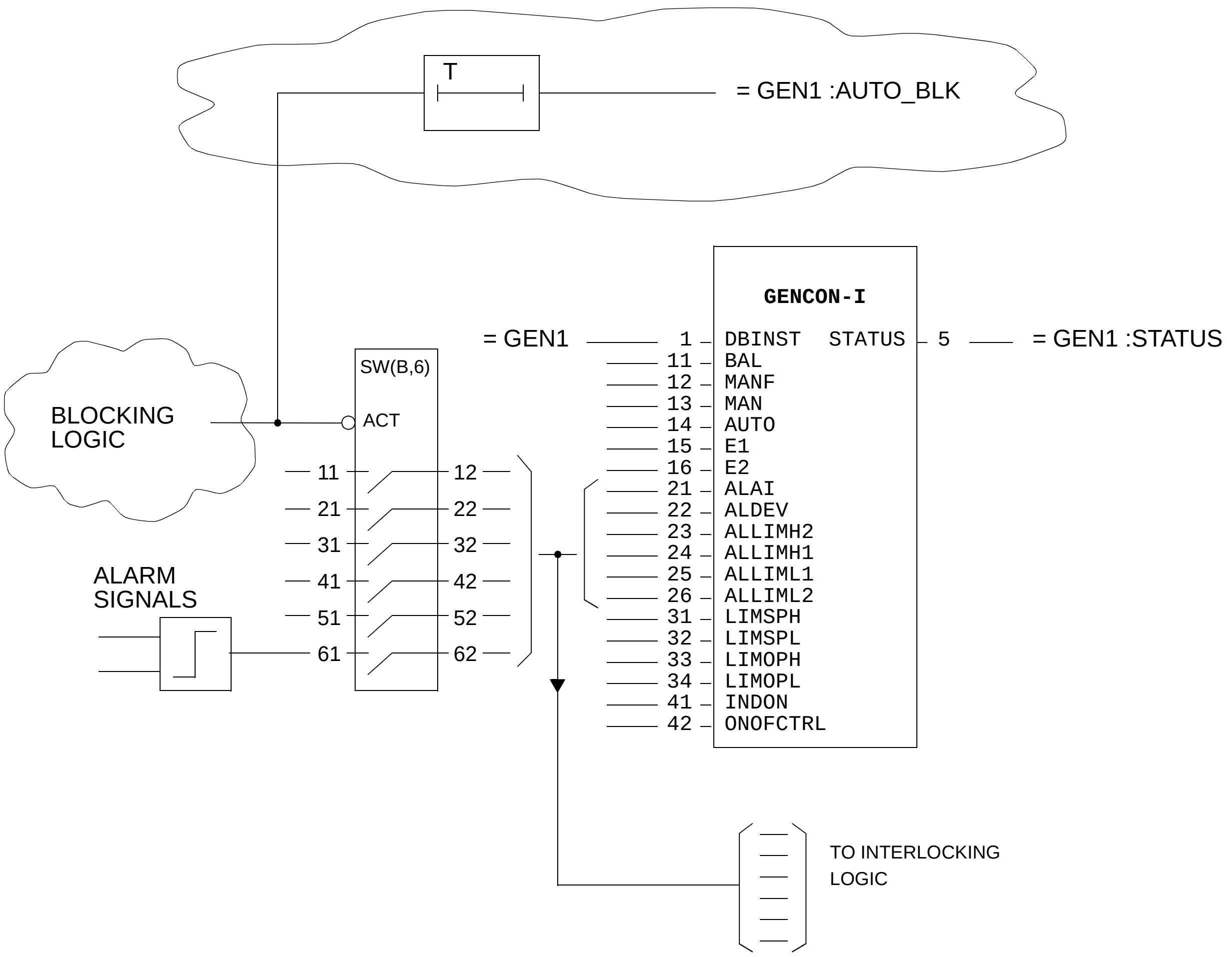


Figure 3-42. GENXXX automatic blocking of both presentation and control function.

3.9.4 MOTCON, VALVECON

Standard functions:

X		X
1	2a	2b

Comments:

- The control signal for automatic blocking is coupled to the AL_P_BLK (ALARM PERIOD BLOCK) connection on the data base element. If this connection is set to 1, all alarm and event handling in Advant Station 500 Series Operator Station for the object concerned is blocked. Printouts on the printer are also blocked. Because these functional units have very powerful alarm and event-handling with respect to protection, interlockings, control modes and so on and because there is a common input for blocking of all alarms and events, the consequences of utilizing the blocking function must be taken into consideration.
- The use in PC programs of status indications which at the configuration have been selected to give alarm and event presentation is not affected by AL_P_BLK.

3.10 Control Mode and Operators Point of Control

In control system applications in which there is continuous interaction between man-machine-process, control modes and the operators point of control are of considerable importance.

Concepts are required which define, for examples, degree of automation and from where a function is controlled if there are several operators stations.

Functional units are used in these applications and the concepts used are often based on traditional terminology which is familiar from regulator type instruments.

In the absence of an international standard covering the needs of a functional completely integrated control system such as ABB Master with parallel handling of closed loop control functions and motor control, a functional unit standard is used. As far as possible, this follows the standard DIN 19237 which is used generally.

In the following, the concepts most frequently utilized by the functional units are listed. The concepts are defined and their uses are described briefly. In some cases an historic reference has been motivated to relate to the use of a control mode in a traditional application. Each functional unit describes in detail any special significance of a control mode or operators point of control.

The control modes (and operators point of control) are often organized in a hierarchy which means that if there are simultaneous demands for two or more control modes, that with the higher priority is selected. This priority logic can be predetermined and incorporated in the functional unit as in PIDCON or it can be defined by the user for example with GENCON and a special PC program.

Control mode

In general the control mode indicates the degree of automation which applies. Figure 3-43 illustrates the significance, in principle, of a number of control modes and the ways in which they differ. MAN for example, stands for a functionally simple control mode in which the operator has the responsibility for the control whereas E2 stands for a high degree of automation with, for example, setpoint calculation performed by an optimizing computer function.

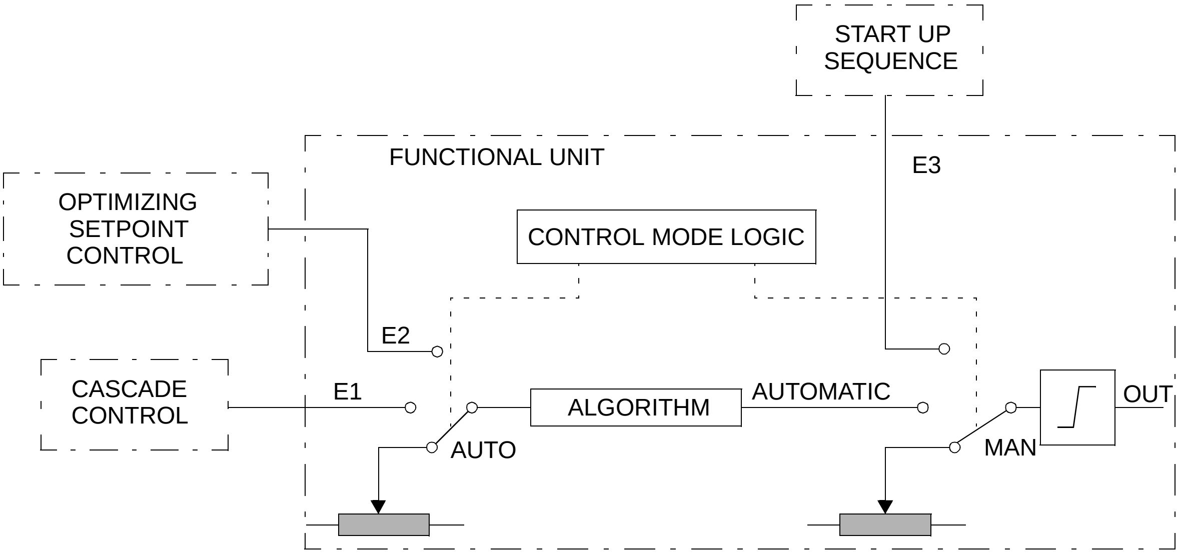


Figure 3-43. Example of different control modes for a control function

BAL, Balance

The control function is balanced in this control mode so that change to another control mode is possible without "bumps" in the control signal to the process.

If the control signal for an actuator is processed in a chain of functional units and possible external apparatus, the preceding unit is balanced when the control chain is broken.

The demand can apply in, for example, the interaction between a controller in ABB Master and a hardware backup station or with cascade controllers. When the inner controller in the cascade is in the MAN or AUTO (constant control) control mode, the outer controller in the cascade is to be balanced.

MAN, Manual

Control through operator intervention.

In a motor control operation, MAN means that start and stop are commanded directly by the operator.

For a controller, the operator sets the value of the output signal. Change to MAN normally means that the value of the output signal is frozen until changed by the operator. In PIDCON, the special control mode MAN CLAMPED can be used to force-control the output signal to a desired value before it is frozen and the MAN control mode is adopted.

AUTO, Automatic

Control without operator intervention.

In the case of a motor control operation, start and stop are completely automatic. For example, a pump motor can be controlled by level monitors in a tank.

For a controller, AUTO means constant regulation of a variable in relation to a fixed setpoint which is normally set by an operator. The controller ensures that the actual value of the variable remains equal to the setpoint, irrespective of interferences in the process.

E1, External 1

A special automatic control mode adapted for controllers. E1 means that the setpoint is accessed from an external setpoint transmitter which can be a cascade-coupled controller (compare the traditional concept CASCADE), a recipe bank for setpoints, an optimizing calculation function and so on.

E2, External 2

Identical with E1 but permits convenient switch-over between two setpoint sources for a controller.

E3, External 3

A special control mode adapted for control of the output signal of controllers. Note that the algorithm of the controller itself is bypassed. Only that part in which the output signal is processed is utilized. Compare the relationship with the control mode MAN. In this case, however, the output signal is determined from an external calculation unit.

Traditionally, the concept DDC (Direct Digital Control) has been used for this control mode which then means that a hardware controller interacts with a master computer. All of the calculation (control algorithm) is performed in the computer while the hardware controller is normally utilized for the adaption of the electrical signal to the process actuator. The control function is utilized as backup in the event of computer malfunction. In ABB Master systems, the function of the hardware controller is completely within a computer system. This does not prevent the control modes from being of equal utility as is explained by a minor application example in connection with Figure 3-44.

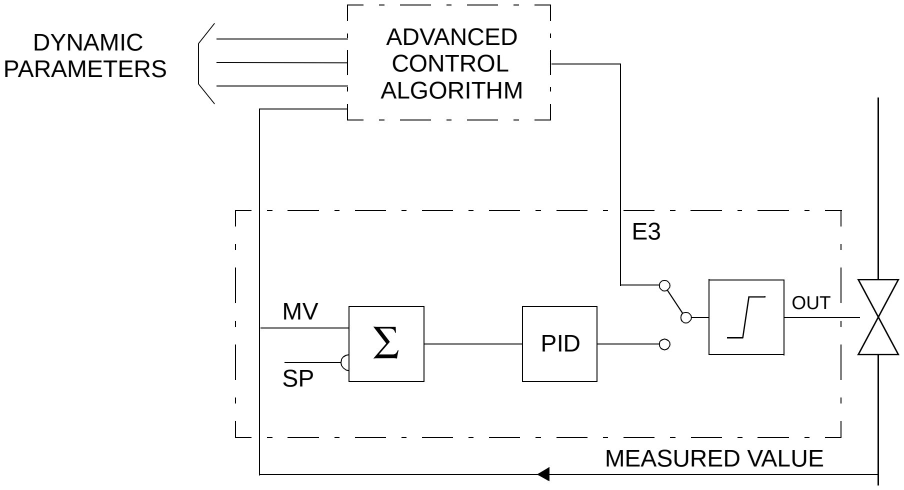


Figure 3-44. Application example for control mode E3

A traditional PID controller is to constitute the basis of a basic function level. In addition, it should be possible to introduce an advanced control function to permit control of many more measured values and parameters than can be processed by the basic level. Its complexity, however, makes the function sensitive to operational interferences and the basic level with constant control (AUTO) is required as backup. The operator can easily manage such a control operation with a controller in the centrum equipped with an extra control input of the type offered by control mode E3.

DB UPDATE BLK, Data base update block

The functional units AI and DI have been allocated a special control mode DB UPDATE BLK which indicates the possibility available to disconnect the acquisition of measured values and status from the process. While the updating is disconnected, the signal value can be simulated by the operator. It is thus possible to give a replacement value for a faulty transducer.

3.10.1 Operators Point of Control

The concepts taken up under the heading “Control mode” and the concepts which in the following tabulation are designated Point of control are not clearly distinguishable. With point of control however, from where a function is controlled, for example if there are several operators workplaces, is defined specially. Point of control is used primarily for control of motors and valves.

STANDBY	When STANDBY is selected, the operation is stopped and blocked from all further control.
CENTRAL	The point of control means that the object is handled from a display screen based operators station.
LOCAL	Local control is possible from an optional place but usually from the physical location of the object in the process. The need for the operator to see that which he controls, perhaps in special operational situations is the reason for this concept.
SEQUENCE (REMOTE)	Both concepts are used for, in principle, the same function where an object is controlled by a master system function such as a sequence or group start. SEQUENCE need not mean that a motor is started automatically but only that it is released for start. It is thus possible to combine SEQUENCE with the control mode MAN (or, naturally, AUTO).
TEST	TEST can mean that an object can be controlled locally but with reduced supervision.

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